Lansing dataset

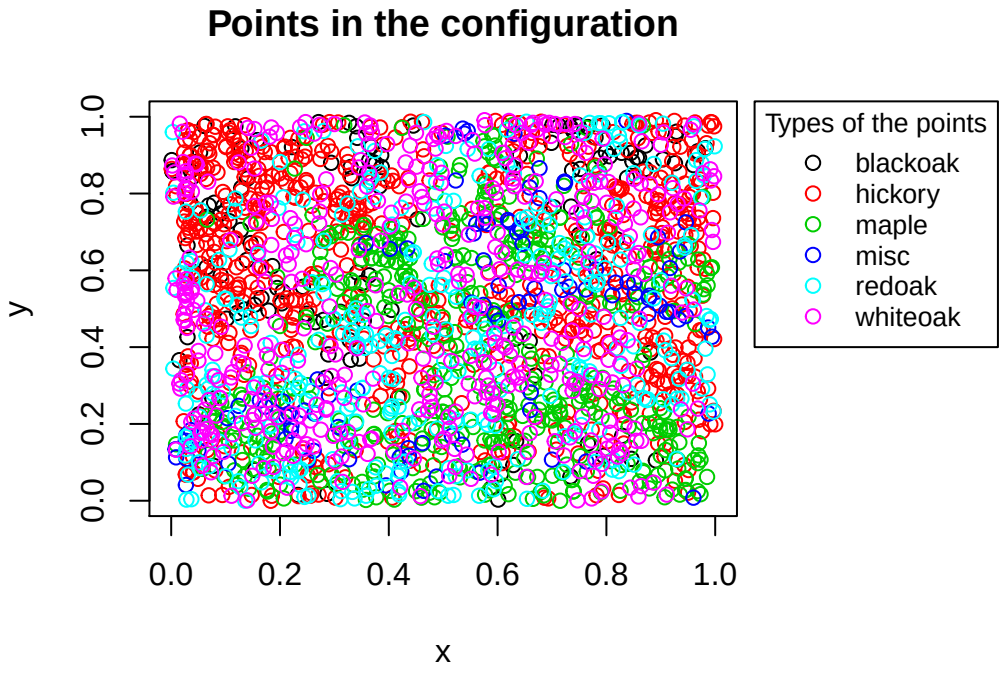
```
library(ppjsdm)
library(spatstat)
#> Loading required package: spatstat.data
#> Loading required package: nlme
#> Loading required package: rpart
#>
#> spatstat 1.63-0       (nickname: 'Space camouflage')
#> For an introduction to spatstat, type 'beginner'
remove(list = ls())

set.seed(1)
```

This vignette explains how to use the `ppjsdm` package with the Lansing dataset from `spatstat`. We begin by loading the data with all species.

```
data(lansing)
configuration <- as.Configuration(lansing)
window <- Rectangle_window(c(0, 1), c(0, 1))
```

The point configuration is plotted below.

```
par(mar = c(5, 4, 4, 13) + 0.1)
plot(configuration, window = window)
```

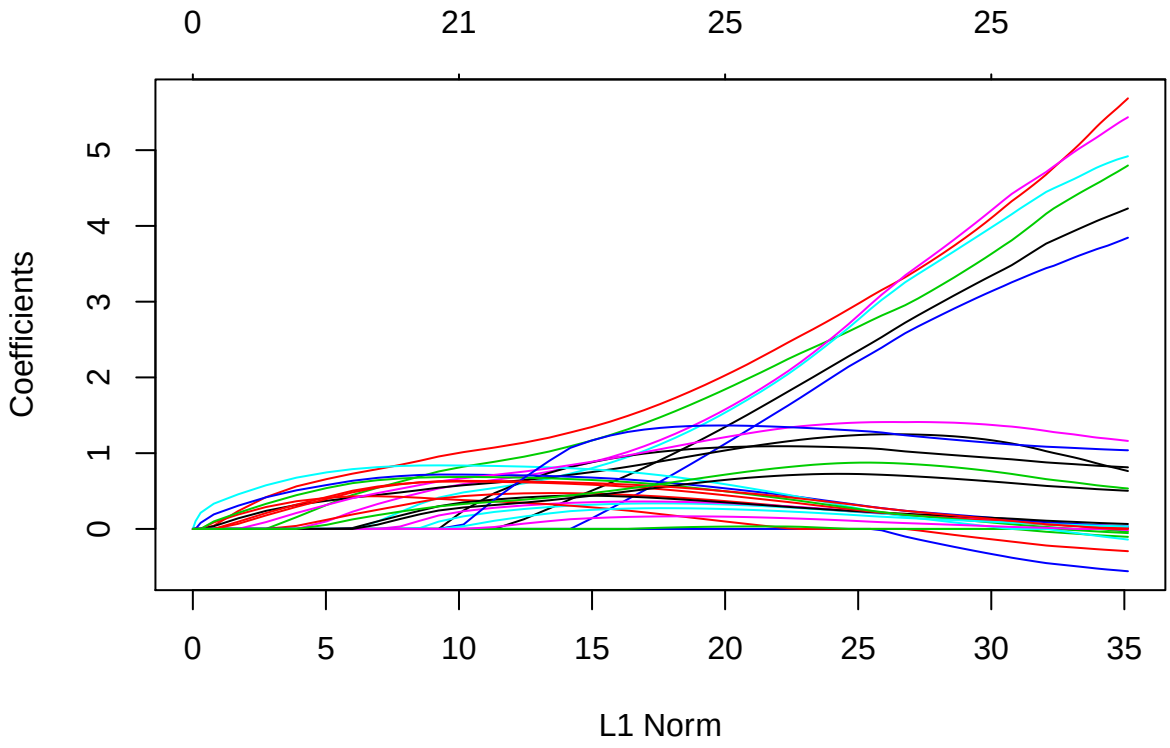


We fit the data with the Geyer model.

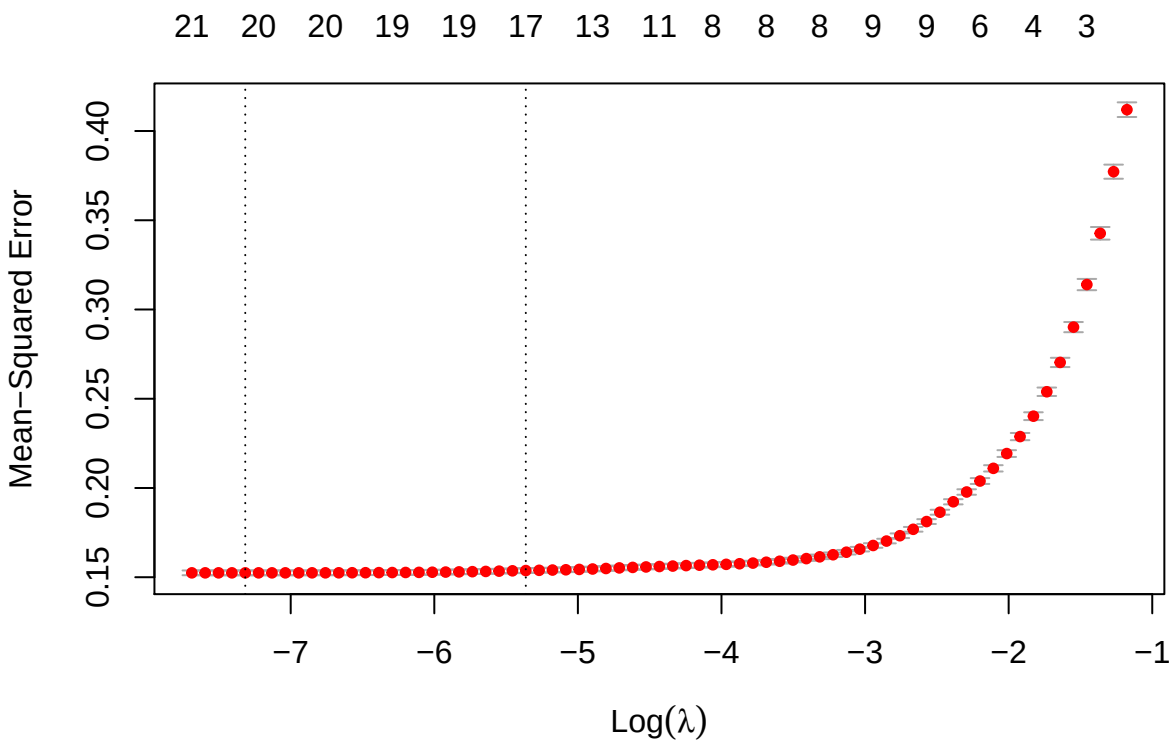
```
radii <- matrix(0.05, 6, 6)
```

The matrix `radii` models interaction radii within a species, and between species.

```
fit <- ppjsdm::gibbsm(configuration,
                      window = window,
                      model = "Geyer",
                      radius = radii,
                      use_glmnet = TRUE)
#> 28 x 1 sparse Matrix of class "dgCMatrix"
#>                            1
#> (Intercept)   .
#> log_lambda_1  4.230335018
#> log_lambda_2  5.683970887
#> log_lambda_3  4.797757367
#> log_lambda_4  3.844489682
#> log_lambda_5  4.919842386
#> log_lambda_6  5.434774974
#> alpha_1_1     0.813012391
#> alpha_1_2     0.001569683
#> alpha_1_3    -0.104694307
#> alpha_1_4    -0.558700449
#> alpha_1_5     0.039665915
#> alpha_1_6     0.032726800
#> alpha_2_2     0.763518819
#> alpha_2_3    -0.293917204
#> alpha_2_4    -0.055047573
#> alpha_2_5     0.026227987
#> alpha_2_6    -0.140863188
#> alpha_3_3     1.161221563
#> alpha_3_4     0.065057299
#> alpha_3_5     0.008619305
#> alpha_3_6    -0.036270818
#> alpha_4_4     1.037896220
#> alpha_4_5     0.032416036
#> alpha_4_6    -0.016324373
#> alpha_5_5     0.503458708
#> alpha_5_6     .
#> alpha_6_6     0.533474729
plot(fit$complete)
```




```
plot(fit$cv)
```




```
print(coefficients(fit$complete))
#> 28 x 77 sparse Matrix of class "dgCMatrix"
#>    [[ suppressing 77 column names 's0', 's1', 's2' ... ]]
#>
#> (Intercept)  . .          .          .          .          .          .
#> log_lambda_1 . .          .          .          .          .          .
#> log_lambda_2 . .          .          0.04195492 0.23653432 0.4195654 0.56192759
#> log_lambda_3 . .          .          .          .          .         0.15497828
#> log_lambda_4 . .          .          .          .          .          .
#> log_lambda_5 . .          .          .          .          .          .
#> log_lambda_6 . .          .          .          .          .          .
#> alpha_1_1    . .          .          .          .          .          .
#> alpha_1_2    . .          .          .          .          .         0.03995353
#> alpha_1_3    . .          .          .          .          .          .
#> alpha_1_4    . .          .          .          .          .          .
#> alpha_1_5    . .          .          .          .          .          .
#> alpha_1_6    . .          .          .          .          .          .
#> alpha_2_2    . .          .          0.03591203 0.13999013 0.2384869 0.31688967
#> alpha_2_3    . .          .          0.08653443 0.19045916 0.2893422 0.36565647
#> alpha_2_4    . .          .          .          .          .          .
#> alpha_2_5    . .          0.08005029 0.19171542 0.30695374 0.4173826 0.50968086
#> alpha_2_6    . 0.1018864  0.21317192 0.33308328 0.45706900 0.5761005 0.67676619
#> alpha_3_3    . .          .          .          .          0.0904692 0.21075067
#> alpha_3_4    . .          .          .          .          .          .
#> alpha_3_5    . .          .          .          0.09486089 0.2094888 0.32115572
#> alpha_3_6    . .          .          0.09876317 0.21260874 0.3312426 0.44596004
```

```
#> alpha_4_4    . .         .          .          .          .          .
#> alpha_4_5    . .         .          .          .          .          .
#> alpha_4_6    . .         .          .          .          .          .
#> alpha_5_5    . .         .          .          .          .          .
#> alpha_5_6    . .         .          .          0.06751951 0.1785882 0.29165540
#> alpha_6_6    . .         .          .          .          .          .
#>
#> (Intercept)  .          .          .          .          .          .
#> log_lambda_1 .          .          .          .          .          .
#> log_lambda_2 0.65822451 0.72888977 0.78887314 0.8451987 0.90045927 0.95640682
#> log_lambda_3 0.31782046 0.44711101 0.54277118 0.6227325 0.69349835 0.75890201
#> log_lambda_4 .          .          .          .          .          .
#> log_lambda_5 .          .          0.09664069 0.2232070 0.33067420 0.41313786
#> log_lambda_6 0.10025233 0.22628964 0.32777791 0.4100723 0.47501036 0.53427201
#> alpha_1_1    .          .          .          .          .          .
#> alpha_1_2    0.12100870 0.19038879 0.25189358 0.3072436 0.35668832 0.39999514
#> alpha_1_3    .          .          .          .          .          .
#> alpha_1_4    .          .          .          .          .          .
#> alpha_1_5    .          .          .          .          0.01264699 0.09671237
#> alpha_1_6    .          .          .          0.0316847 0.10891517 0.17772444
#> alpha_2_2    0.37176345 0.41304476 0.44836341 0.4812837 0.51311759 0.54465251
#> alpha_2_3    0.41068244 0.42992824 0.43101448 0.4236035 0.41147778 0.39673166
#> alpha_2_4    .          .          .          .          .          .
#> alpha_2_5    0.57968014 0.63529363 0.67404303 0.6976644 0.71239663 0.71761479
#> alpha_2_6    0.74681832 0.78910600 0.81554772 0.8310470 0.83719775 0.83872756
#> alpha_3_3    0.31749775 0.40542031 0.47273394 0.5296470 0.58007294 0.62628068
#> alpha_3_4    .          0.01114993 0.09963771 0.1756482 0.24162392 0.29946751
#> alpha_3_5    0.42066652 0.50366087 0.55951318 0.5936914 0.61469995 0.62446023
#> alpha_3_6    0.53999960 0.60405315 0.64284355 0.6659787 0.67792375 0.68399635
#> alpha_4_4    .          .          .          .          .          .
#> alpha_4_5    .          .          .          .          .          .
#> alpha_4_6    .          .          .          .          .          .
#> alpha_5_5    .          .          0.05547370 0.1309209 0.19421273 0.24320914
#> alpha_5_6    0.39547405 0.48252744 0.54696147 0.5888639 0.61502636 0.62851164
#> alpha_6_6    0.05443216 0.12504948 0.18197853 0.2281617 0.26467808 0.29783821
#>
#> (Intercept)  .          .          .          .          .          .
#> log_lambda_1 .          .          0.12768090 0.2689599 0.3908606 0.5022920
#> log_lambda_2 1.01401580 1.07383007 1.13814554 1.2045772 1.2730787 1.3435373
#> log_lambda_3 0.82208083 0.88641193 0.95308339 1.0214006 1.0916414 1.1645770
#> log_lambda_4 .          .          .          .          .         0.1361466
#> log_lambda_5 0.48221281 0.54037926 0.60132829 0.6642703 0.7299819 0.7997693
#> log_lambda_6 0.59244317 0.64655640 0.69964445 0.7556565 0.8148422 0.8781664
#> alpha_1_1    0.24208747 0.47115864 0.63056614 0.7391163 0.8186041 0.8792546
#> alpha_1_2    0.43357779 0.45774366 0.46958141 0.4729148 0.4713107 0.4662659
#> alpha_1_3    .          .          .          .          .          .
#> alpha_1_4    .          .          .          .          .          .
#> alpha_1_5    0.16631196 0.22406893 0.26285569 0.2887072 0.3071591 0.3196692
#> alpha_1_6    0.23360212 0.27889635 0.30983238 0.3298829 0.3437140 0.3526212
#> alpha_2_2    0.57681869 0.60995954 0.64405687 0.6788847 0.7139921 0.7491610
#> alpha_2_3    0.38054177 0.36379106 0.34572726 0.3264884 0.3063137 0.2854126
#> alpha_2_4    .          .          .          .          .          .
#> alpha_2_5    0.71712341 0.71248504 0.70623745 0.6985066 0.6891580 0.6783585
```

```
#> alpha_2_6    0.83671604 0.83119013 0.82306064 0.8131449 0.8012205 0.7873046
#> alpha_3_3    0.66999301 0.71314807 0.75657051 0.7997178 0.8427290 0.8859204
#> alpha_3_4    0.34968851 0.38817244 0.41518918 0.4317327 0.4404582 0.4391568
#> alpha_3_5    0.62596492 0.62127230 0.61450876 0.6057959 0.5953497 0.5838879
#> alpha_3_6    0.68578576 0.68335548 0.67648988 0.6678929 0.6575227 0.6460730
#> alpha_4_4    0.05776461 0.38733609 0.67166021 0.8968306 1.0700935 1.1660935
#> alpha_4_5    0.03610124 0.10752792 0.16327042 0.2045116 0.2348320 0.2512207
#> alpha_4_6    .          0.02506294 0.06941764 0.1027556 0.1278276 0.1418521
#> alpha_5_5    0.28306174 0.31551527 0.34675256 0.3774462 0.4074473 0.4374580
#> alpha_5_6    0.63406403 0.63225110 0.62700871 0.6206740 0.6131651 0.6050968
#> alpha_6_6    0.32935290 0.35840072 0.38571959 0.4138199 0.4424457 0.4717915
#>
#> (Intercept)  .          .          .          .         .         .
#> log_lambda_1 0.6069208 0.7087747 0.807835343 0.90615527 1.00447284 1.10321466
#> log_lambda_2 1.4165090 1.4920960 1.568668255 1.64780292 1.72942963 1.81343664
#> log_lambda_3 1.2385780 1.3147855 1.393168384 1.47312515 1.55455722 1.63737596
#> log_lambda_4 0.2666327 0.3916950 0.508657067 0.62357014 0.73745231 0.85076881
#> log_lambda_5 0.8725811 0.9493603 1.030149421 1.11470648 1.20313123 1.29549487
#> log_lambda_6 0.9450960 1.0162741 1.091851164 1.17165590 1.25579702 1.34435064
#> alpha_1_1    0.9265711 0.9643370 0.994208873 1.01830896 1.03774553 1.05330544
#> alpha_1_2    0.4587031 0.4491122 0.439198899 0.42794582 0.41555699 0.40224988
#> alpha_1_3    .          .          .          .         .         .
#> alpha_1_4    .          .          .          .         .         .
#> alpha_1_5    0.3282371 0.3336682 0.336491664 0.33724270 0.33621627 0.33363302
#> alpha_1_6    0.3583007 0.3612287 0.361949184 0.36087625 0.35824513 0.35423334
#> alpha_2_2    0.7846541 0.8200388 0.855057319 0.88985868 0.92425634 0.95805526
#> alpha_2_3    0.2639069 0.2420243 0.219040697 0.19609059 0.17333178 0.15088030
#> alpha_2_4    .          .         0.007895665 0.01460865 0.02007658 0.02444875
#> alpha_2_5    0.6660181 0.6522039 0.636633052 0.61992839 0.60223842 0.58368600
#> alpha_2_6    0.7710043 0.7526454 0.731794890 0.70904644 0.68456703 0.65851417
#> alpha_3_3    0.9284504 0.9703051 1.011470276 1.05151341 1.09026926 1.12756812
#> alpha_3_4    0.4339873 0.4264473 0.416845604 0.40601366 0.39429608 0.38195197
#> alpha_3_5    0.5711743 0.5569404 0.541670410 0.52529262 0.50797518 0.48988515
#> alpha_3_6    0.6332194 0.6185997 0.602690914 0.58539456 0.56684288 0.54718687
#> alpha_4_4    1.2326248 1.2800600 1.311460489 1.33350301 1.34854048 1.35814073
#> alpha_4_5    0.2620169 0.2689503 0.272529804 0.27392130 0.27353553 0.27164514
#> alpha_4_6    0.1515477 0.1582875 0.162465508 0.16496631 0.16608493 0.16601011
#> alpha_5_5    0.4666950 0.4949815 0.522410676 0.54868485 0.57365638 0.59718034
#> alpha_5_6    0.5959385 0.5857124 0.574572499 0.56241850 0.54929097 0.53524872
#> alpha_6_6    0.5015093 0.5313801 0.561408092 0.59130492 0.62087895 0.64992375
#>
#> (Intercept)  .          .          .          .         .         .
#> log_lambda_1 1.20260297 1.30293132 1.40367979 1.50490954 1.60833111 1.70996620
#> log_lambda_2 1.89968041 1.98861364 2.07883556 2.17068609 2.26784266 2.36308804
#> log_lambda_3 1.72147490 1.80625209 1.89251124 1.97967113 2.06586194 2.15327931
#> log_lambda_4 0.96369234 1.07640575 1.18834090 1.29942660 1.41095853 1.51978451
#> log_lambda_5 1.39180731 1.49154833 1.59555467 1.70311900 1.81266871 1.92582852
#> log_lambda_6 1.43732908 1.53431022 1.63596165 1.74164424 1.85185597 1.96451352
#> alpha_1_1    1.06557881 1.07509749 1.08208311 1.08693331 1.09023675 1.09163528
#> alpha_1_2    0.38821249 0.37357567 0.35856384 0.34327140 0.32751383 0.31198619
#> alpha_1_3    .          .          .          .         .         .
#> alpha_1_4    .          .          .          .         .         .
#> alpha_1_5    0.32967201 0.32443247 0.31816134 0.31093278 0.30243091 0.29359205
```

```
#> alpha_1_6    0.34898732 0.34257340 0.33523636 0.32702359 0.31773565 0.30805295
#> alpha_2_2    0.99104887 1.02262581 1.05335630 1.08262071 1.10869224 1.13379839
#> alpha_2_3    0.12883881 0.10712999 0.08617266 0.06584702 0.04543328 0.02637753
#> alpha_2_4    0.02783803 0.03027963 0.03196842 0.03291272 0.03294863 0.03254638
#> alpha_2_5    0.56439909 0.54455628 0.52419538 0.50350423 0.48287232 0.46204773
#> alpha_2_6    0.63107249 0.60260659 0.57300541 0.54270959 0.51194949 0.48116788
#> alpha_3_3    1.16323808 1.19725365 1.22919059 1.25900114 1.28817981 1.31381883
#> alpha_3_4    0.36918781 0.35617842 0.34306092 0.32995884 0.31692220 0.30415180
#> alpha_3_5    0.47118785 0.45219451 0.43275116 0.41316485 0.39376599 0.37443154
#> alpha_3_6    0.52658637 0.50530562 0.48330410 0.46087197 0.43798845 0.41527732
#> alpha_4_4    1.36345145 1.36533410 1.36451000 1.36153565 1.35658931 1.35055358
#> alpha_4_5    0.26845904 0.26415720 0.25886275 0.25272691 0.24581440 0.23835738
#> alpha_4_6    0.16488222 0.16277128 0.15985486 0.15618602 0.15160578 0.14661170
#> alpha_5_5    0.61910923 0.63923388 0.65752782 0.67382541 0.68732357 0.69913952
#> alpha_5_6    0.52035275 0.50480960 0.48841781 0.47138451 0.45485376 0.43711550
#> alpha_6_6    0.67821001 0.70538361 0.73139958 0.75588531 0.77773599 0.79813756
#>
#> (Intercept)  .          .          .          .          .
#> log_lambda_1 1.81109926 1.90889042 2.00407898 2.09778791 2.18945970
#> log_lambda_2 2.45905152 2.54967250 2.63619628 2.72344544 2.81124093
#> log_lambda_3 2.24093438 2.32011415 2.39341613 2.46471778 2.53551610
#> log_lambda_4 1.62671102 1.73370460 1.83992317 1.94396928 2.04494827
#> log_lambda_5 2.04123834 2.16170555 2.28505828 2.40794659 2.53129328
#> log_lambda_6 2.07995224 2.20075089 2.32506413 2.44992881 2.57629797
#> alpha_1_1    1.09165422 1.08985315 1.08699364 1.08345037 1.07930244
#> alpha_1_2    0.29651692 0.28281230 0.27018270 0.25782964 0.24581741
#> alpha_1_3    .          .          .          .          .
#> alpha_1_4    .          .          .          .          .
#> alpha_1_5    0.28415936 0.27438328 0.26425278 0.25375952 0.24308972
#> alpha_1_6    0.29783022 0.28728426 0.27637538 0.26516896 0.25383089
#> alpha_2_2    1.15678866 1.17720177 1.19490980 1.20956292 1.22187566
#> alpha_2_3    0.00806027 .          .          .          .
#> alpha_2_4    0.03159461 0.02786222 0.02133854 0.01448354 0.00751471
#> alpha_2_5    0.44135014 0.41953430 0.39700862 0.37528814 0.35411836
#> alpha_2_6    0.45053035 0.41860153 0.38637057 0.35529524 0.32500734
#> alpha_3_3    1.33702911 1.35525898 1.36907881 1.38116835 1.39121073
#> alpha_3_4    0.29166707 0.28000966 0.26920061 0.25890508 0.24912590
#> alpha_3_5    0.35536262 0.33593344 0.31643553 0.29784843 0.27995172
#> alpha_3_6    0.39266574 0.36975512 0.34641079 0.32390257 0.30207754
#> alpha_4_4    1.34355037 1.33603444 1.32825867 1.31995615 1.31140436
#> alpha_4_5    0.23042626 0.22216315 0.21381327 0.20523493 0.19648857
#> alpha_4_6    0.14111718 0.13526454 0.12931709 0.12295242 0.11633003
#> alpha_5_5    0.70872701 0.71639129 0.72233212 0.72581555 0.72716307
#> alpha_5_6    0.41908101 0.40062906 0.38210901 0.36391938 0.34570378
#> alpha_6_6    0.81628609 0.83251795 0.84669075 0.85787308 0.86627323
#>
#> (Intercept)  .           .          .           .           .
#> log_lambda_1 2.2785585243 2.3628503 2.44402215  2.53166124  2.62941010
#> log_lambda_2 2.8990045466 2.9844217 3.06871652  3.15361618  3.23752537
#> log_lambda_3 2.6058570420 2.6772837 2.74676754  2.81685827  2.88483664
#> log_lambda_4 2.1419900680 2.2265447 2.30659604  2.39302730  2.49096092
#> log_lambda_5 2.6545426999 2.7796410 2.90165941  3.02297161  3.13991189
#> log_lambda_6 2.7036646264 2.8340358 2.96262514  3.09224548  3.21899271
```

```
#> alpha_1_1    1.0746984268 1.0693293 1.06380729  1.05395544  1.03824260
#> alpha_1_2    0.2342102020 0.2246979 0.21573296  0.20723051  0.19915386
#> alpha_1_3    .            .         .           .           .
#> alpha_1_4    .            .         .          -0.01804961 -0.06064505
#> alpha_1_5    0.2323804176 0.2215930 0.21085721  0.20081027  0.19155969
#> alpha_1_6    0.2424770951 0.2310904 0.21979323  0.20910852  0.19916958
#> alpha_2_2    1.2319069836 1.2400803 1.24551542  1.24883815  1.24973343
#> alpha_2_3    .            .         .           .           .
#> alpha_2_4    0.0005126195 .         .           .           .
#> alpha_2_5    0.3335931614 0.3130062 0.29344787  0.27440410  0.25638281
#> alpha_2_6    0.2957014755 0.2665549 0.23903996  0.21230531  0.18712573
#> alpha_3_3    1.3992136137 1.4048366 1.40873035  1.41055443  1.41108724
#> alpha_3_4    0.2398741164 0.2310987 0.22281357  0.21483952  0.20703396
#> alpha_3_5    0.2627638134 0.2460613 0.23035919  0.21523564  0.20107600
#> alpha_3_6    0.2809784750 0.2604430 0.24100076  0.22218936  0.20441299
#> alpha_4_4    1.3029119344 1.2941320 1.28547456  1.27276421  1.25400996
#> alpha_4_5    0.1877208119 0.1785772 0.16957405  0.16103512  0.15305339
#> alpha_4_6    0.1095998508 0.1025996 0.09552771  0.08899163  0.08300578
#> alpha_5_5    0.7265279354 0.7242482 0.72028098  0.71480079  0.70800432
#> alpha_5_6    0.3274912289 0.3089843 0.29121173  0.27330880  0.25619623
#> alpha_6_6    0.8718936968 0.8749305 0.87522607  0.87283298  0.86800914
#>
#> (Intercept)   .           .         .           .           .
#> log_lambda_1  2.72261566  2.81898913  2.91172979  2.99930762  3.08173025
#> log_lambda_2  3.32205445  3.42541925  3.53167055  3.63593723  3.73843981
#> log_lambda_3  2.95306849  3.04152428  3.13685125  3.23022866  3.31927890
#> log_lambda_4  2.58342100  2.67239737  2.75620747  2.83477464  2.90850430
#> log_lambda_5  3.25565805  3.36393209  3.46878289  3.56906858  3.66400198
#> log_lambda_6  3.34651385  3.46899234  3.58945643  3.70630102  3.81892736
#> alpha_1_1     1.02325488  1.00981553  0.99706126  0.98497709  0.97365783
#> alpha_1_2     0.19147806  0.17952002  0.16735951  0.15590701  0.14512989
#> alpha_1_3     .           .           .           .           .
#> alpha_1_4    -0.10055465 -0.13809038 -0.17320842 -0.20600924 -0.23654661
#> alpha_1_5     0.18238261  0.17325629  0.16438043  0.15577611  0.14740251
#> alpha_1_6     0.18931172  0.17955439  0.17005705  0.16084139  0.15198438
#> alpha_2_2     1.24857881  1.24513222  1.23975760  1.23212283  1.22245615
#> alpha_2_3     .          -0.01895864 -0.04040568 -0.06035459 -0.07913161
#> alpha_2_4     .           .           .           .           .
#> alpha_2_5     0.23892755  0.22466739  0.21128198  0.19863324  0.18674355
#> alpha_2_6     0.16274659  0.14185449  0.12203707  0.10340643  0.08586640
#> alpha_3_3     1.40977197  1.41137483  1.40980656  1.40617495  1.40245844
#> alpha_3_4     0.19969131  0.19149771  0.18347649  0.17592790  0.16870996
#> alpha_3_5     0.18747036  0.17516258  0.16337589  0.15222669  0.14143534
#> alpha_3_6     0.18729698  0.17154595  0.15659013  0.14242197  0.12893297
#> alpha_4_4     1.23636279  1.21985268  1.20454023  1.19021952  1.17682948
#> alpha_4_5     0.14514423  0.13751754  0.13017116  0.12314004  0.11644231
#> alpha_4_6     0.07700976  0.07114564  0.06539537  0.05978850  0.05434960
#> alpha_5_5     0.70022931  0.69128383  0.68179979  0.67205015  0.66188288
#> alpha_5_6     0.23914930  0.22263385  0.20662794  0.19152270  0.17809856
#> alpha_6_6     0.86090664  0.85120932  0.83995274  0.82758122  0.81396676
#>
#> (Intercept)   .           .         .           .           .
#> log_lambda_1  3.15988196  3.23281249  3.30145525  3.36599296  3.426302860
```

```
#> log_lambda_2  3.84174994  3.94157318  4.04115769  4.14100284  4.239611141
#> log_lambda_3  3.40978633  3.49465831  3.57802390  3.66071478  3.740782424
#> log_lambda_4  2.97719824  3.04123009  3.10083732  3.15621115  3.207574133
#> log_lambda_5  3.75773456  3.84463718  3.92840023  4.00917141  4.085583289
#> log_lambda_6  3.93167196  4.03741861  4.14084105  4.24218515  4.339364807
#> alpha_1_1     0.96280981  0.95273030  0.94323763  0.93432037  0.926016719
#> alpha_1_2     0.13500291  0.12552425  0.11663888  0.10831814  0.100546326
#> alpha_1_3     .           .           .           .           .
#> alpha_1_4    -0.26508111 -0.29158834 -0.31623416 -0.33911764 -0.360322226
#> alpha_1_5     0.13938509  0.13175829  0.12446217  0.11750806  0.110928462
#> alpha_1_6     0.14331835  0.13508100  0.12715242  0.11953025  0.112275542
#> alpha_2_2     1.21048473  1.19691387  1.18156313  1.16439489  1.145807860
#> alpha_2_3    -0.09643691 -0.11262360 -0.12771859 -0.14181939 -0.155013570
#> alpha_2_4     .           .           .           .           .
#> alpha_2_5     0.17502807  0.16429973  0.15394301  0.14391203  0.134407480
#> alpha_2_6     0.06870723  0.05303437  0.03791693  0.02326536  0.009374959
#> alpha_3_3     1.39529690  1.38806917  1.37953928  1.36942572  1.358578833
#> alpha_3_4     0.16209340  0.15590972  0.15015312  0.14480147  0.139830187
#> alpha_3_5     0.13123505  0.12186165  0.11288840  0.10429471  0.096212072
#> alpha_3_6     0.11590945  0.10387380  0.09232875  0.08124593  0.070781705
#> alpha_4_4     1.16441986  1.15286446  1.14218082  1.13234995  1.123296237
#> alpha_4_5     0.10998021  0.10390867  0.09812816  0.09264884  0.087501573
#> alpha_4_6     0.04909130  0.04403087  0.03917686  0.03452912  0.030096664
#> alpha_5_5     0.65193564  0.64214000  0.63248307  0.62304756  0.613936885
#> alpha_5_6     0.16400494  0.15125749  0.13892723  0.12693524  0.115613043
#> alpha_6_6     0.79962795  0.78519533  0.77028196  0.75495502  0.739650621
#>
#> (Intercept)   .           .           .           .           .
#> log_lambda_1  3.48139167  3.545859462  3.60708877  3.66394026  3.71715788
#> log_lambda_2  4.32570694  4.401756129  4.47407984  4.54376613  4.61219503
#> log_lambda_3  3.80910732  3.886815503  3.96002730  4.02934162  4.09685789
#> log_lambda_4  3.25493408  3.298277940  3.33880275  3.37618253  3.41061092
#> log_lambda_5  4.15355140  4.224721668  4.28622333  4.34349163  4.39793773
#> log_lambda_6  4.42168123  4.490286487  4.55116187  4.60782142  4.66176423
#> alpha_1_1     0.91856876  0.909597388  0.90091610  0.89284220  0.88527593
#> alpha_1_2     0.09330135  0.086153039  0.07954804  0.07341228  0.06768615
#> alpha_1_3     .          -0.007244888 -0.01570575 -0.02356851 -0.03092538
#> alpha_1_4    -0.37986447 -0.396761073 -0.41200304 -0.42607824 -0.43907149
#> alpha_1_5     0.10498064  0.099339212  0.09422016  0.08941519  0.08487025
#> alpha_1_6     0.10541528  0.098009896  0.09134597  0.08511839  0.07922259
#> alpha_2_2     1.12820706  1.107676550  1.08711777  1.06672759  1.04607651
#> alpha_2_3    -0.16729624 -0.179127680 -0.19015728 -0.20044044 -0.21007968
#> alpha_2_4     .           .           .           .           .
#> alpha_2_5     0.12585804  0.116925340  0.10925183  0.10209020  0.09524255
#> alpha_2_6     .           .           .           .           .
#> alpha_3_3     1.35079850  1.339618402  1.32822436  1.31698744  1.30521659
#> alpha_3_4     0.13520359  0.129276503  0.12339622  0.11795133  0.11290255
#> alpha_3_5     0.08934390  0.082002043  0.07572443  0.06985661  0.06423787
#> alpha_3_6     0.06129217  0.052725068  0.04528819  0.03835213  0.03178582
#> alpha_4_4     1.11482859  1.107730693  1.10136600  1.09551719  1.09018222
#> alpha_4_5     0.08269691  0.078098688  0.07399579  0.07017506  0.06660055
#> alpha_4_6     0.02607352  0.023535665  0.02096905  0.01857647  0.01637104
#> alpha_5_5     0.60536131  0.596750925  0.58886319  0.58141369  0.57433729
```

```
#> alpha_5_6     0.10577921  0.094813745  0.08576029  0.07741917  0.06946885
#> alpha_6_6     0.72558838  0.710021984  0.69567000  0.68219409  0.66922326
#>
#> (Intercept)   .             .            .           .           .
#> log_lambda_1  3.7665829119  3.8121297120  3.854295899  3.893452902  3.929602571
#> log_lambda_2  4.6786748890  4.7708393708  4.854456406  4.932575167  5.005769672
#> log_lambda_3  4.1613059976  4.2312210096  4.287543112  4.338829059  4.386385547
#> log_lambda_4  3.4422678982  3.4738970700  3.511543085  3.546832739  3.579406079
#> log_lambda_5  4.4486644427  4.4969840446  4.539409197  4.579144244  4.615955586
#> log_lambda_6  4.7123772281  4.7867942315  4.852694534  4.914221368  4.971339355
#> alpha_1_1     0.8782454499  0.8713782626  0.865540900  0.860117027  0.855117739
#> alpha_1_2     0.0623724395  0.0576744226  0.052201058  0.047110308  0.042400527
#> alpha_1_3    -0.0377812938 -0.0444811364 -0.050505177 -0.056044172 -0.061146987
#> alpha_1_4    -0.4510436419 -0.4620609728 -0.471889416 -0.480980514 -0.489338303
#> alpha_1_5     0.0806076259  0.0764457065  0.072833988  0.069453106  0.066320635
#> alpha_1_6     0.0737320470  0.0693517996  0.065498627  0.061870189  0.058484958
#> alpha_2_2     1.0255770197  1.0024271950  0.982402233  0.963491625  0.945453824
#> alpha_2_3    -0.2190905706 -0.2272605531 -0.233754209 -0.239720753 -0.245259417
#> alpha_2_4     .            -0.0001101508 -0.005345939 -0.010234028 -0.014769797
#> alpha_2_5     0.0888525796  0.0826905783  0.077355415  0.072348531  0.067702666
#> alpha_2_6    -0.0003027725 -0.0143016955 -0.027101083 -0.038938880 -0.049834175
#> alpha_3_3     1.2934168686  1.2781844292  1.267102284  1.257259330  1.248090561
#> alpha_3_4     0.1082280885  0.1039018229  0.099984778  0.096366236  0.093034204
#> alpha_3_5     0.0589558167  0.0537180217  0.049294315  0.045186387  0.041386498
#> alpha_3_6     0.0257315278  0.0191156690  0.013009599  0.007325110  0.002050896
#> alpha_4_4     1.0853102848  1.0810672666  1.076783367  1.072685188  1.068909999
#> alpha_4_5     0.0632946904  0.0602985963  0.057604836  0.055033641  0.052651749
#> alpha_4_6     0.0143486159  0.0109266884  0.007730611  0.004707142  0.001895580
#> alpha_5_5     0.5676995769  0.5614217648  0.555684050  0.550308671  0.545313603
#> alpha_5_6     0.0621445701  0.0553065432  0.049270104  0.043582456  0.038305285
#> alpha_6_6     0.6570483583  0.6447404099  0.634379873  0.624608051  0.615415678
#>
#> (Intercept)   .             .            .           .           .
#> log_lambda_1  3.96227738  3.99075408  4.01684741  4.04164591  4.06289167
#> log_lambda_2  5.07432478  5.13792518  5.19718825  5.25635122  5.30589291
#> log_lambda_3  4.42928542  4.46582890  4.49833453  4.52964737  4.55605137
#> log_lambda_4  3.60823773  3.63179084  3.65351773  3.67385010  3.69200044
#> log_lambda_5  4.65170600  4.68449288  4.71437836  4.74329026  4.76752673
#> log_lambda_6  5.02053340  5.06143787  5.09887751  5.13472010  5.16540843
#> alpha_1_1     0.85037997  0.84602348  0.84205004  0.83835311  0.83506341
#> alpha_1_2     0.03802908  0.03398249  0.03025138  0.02654050  0.02361377
#> alpha_1_3    -0.06605744 -0.07066249 -0.07484657 -0.07875943 -0.08221961
#> alpha_1_4    -0.49704184 -0.50419305 -0.51076259 -0.51682834 -0.52231654
#> alpha_1_5     0.06335415  0.06068428  0.05822012  0.05597033  0.05385751
#> alpha_1_6     0.05611221  0.05487301  0.05372790  0.05260885  0.05170551
#> alpha_2_2     0.92823464  0.91183338  0.89626710  0.88033301  0.86698241
#> alpha_2_3    -0.25039475 -0.25515344 -0.25955938 -0.26367042 -0.26745966
#> alpha_2_4    -0.01897887 -0.02287674 -0.02650002 -0.03010054 -0.03301955
#> alpha_2_5     0.06332302  0.05923592  0.05549684  0.05166628  0.04873078
#> alpha_2_6    -0.05972248 -0.06841696 -0.07633551 -0.08390067 -0.09042587
#> alpha_3_3     1.23808662  1.22869379  1.22059752  1.21225776  1.20620988
#> alpha_3_4     0.08992340  0.08701499  0.08435256  0.08197785  0.07965713
#> alpha_3_5     0.03751852  0.03407057  0.03093241  0.02818773  0.02537276
```

```
#> alpha_3_6     .           .           .           .           .
#> alpha_4_4     1.06549729  1.06238408  1.05949622  1.05686008  1.05440828
#> alpha_4_5     0.05049008  0.04851340  0.04668444  0.04493772  0.04343251
#> alpha_4_6     .           .           .           .           .
#> alpha_5_5     0.54066046  0.53640377  0.53246596  0.52896633  0.52548642
#> alpha_5_6     0.03285349  0.02777699  0.02321909  0.01844219  0.01513754
#> alpha_6_6     0.60652812  0.59806305  0.59019878  0.58294593  0.57616998
#>
#> (Intercept)   .           .           .           .           .
#> log_lambda_1  4.08470301  4.104752666  4.123013998  4.141123814  4.157276547
#> log_lambda_2  5.35699437  5.403491754  5.444794068  5.484935295  5.520284946
#> log_lambda_3  4.58473555  4.613832725  4.640769367  4.667298194  4.690394938
#> log_lambda_4  3.70933057  3.724949035  3.739613480  3.757122669  3.772976037
#> log_lambda_5  4.79037594  4.810906568  4.829211537  4.846930834  4.862285501
#> log_lambda_6  5.20052830  5.234684145  5.265154169  5.295881840  5.322792783
#> alpha_1_1     0.83205350  0.829330222  0.826861699  0.824560209  0.822489928
#> alpha_1_2     0.02045713  0.017771380  0.015329701  0.013042614  0.010982566
#> alpha_1_3    -0.08525642 -0.087962936 -0.090456654 -0.092821878 -0.094961650
#> alpha_1_4    -0.52743226 -0.532069200 -0.536267868 -0.540027678 -0.543456161
#> alpha_1_5     0.05201354  0.050256492  0.048676409  0.047150555  0.045816002
#> alpha_1_6     0.04989391  0.047899708  0.046026752  0.043708168  0.041658897
#> alpha_2_2     0.85306599  0.840357623  0.829112518  0.818140731  0.808498732
#> alpha_2_3    -0.27093237 -0.274216433 -0.277209149 -0.280026849 -0.282551690
#> alpha_2_4    -0.03611867 -0.038791745 -0.041211799 -0.043502061 -0.045575314
#> alpha_2_5     0.04553815  0.042783862  0.040350057  0.037967271  0.035904480
#> alpha_2_6    -0.09703929 -0.103227169 -0.108725627 -0.114130742 -0.118902716
#> alpha_3_3     1.20079298  1.196087559  1.191495731  1.186424074  1.182076152
#> alpha_3_4     0.07774005  0.075920887  0.074259054  0.072717522  0.071316524
#> alpha_3_5     0.02346148  0.021460988  0.019633081  0.017774713  0.016191918
#> alpha_3_6    -0.00375955 -0.008771610 -0.013240038 -0.017161520 -0.020585198
#> alpha_4_4     1.05210250  1.050006031  1.048138939  1.046399110  1.044810949
#> alpha_4_5     0.04188332  0.040490679  0.039262773  0.038107242  0.037085083
#> alpha_4_6     .           .           -0.000404517 -0.003006114 -0.005365966
#> alpha_5_5     0.52258794  0.519742196  0.517201069  0.514740004  0.512631029
#> alpha_5_6     0.01154453  0.008677634  0.006153728  0.003783491  0.001701461
#> alpha_6_6     0.57037980  0.565072136  0.560439600  0.555854655  0.551902463
#>
#> (Intercept)   .           .           .           .           .
#> log_lambda_1  4.172247087  4.185927516  4.199142875  4.209413431  4.220347152
#> log_lambda_2  5.553211563  5.583838555  5.614141748  5.637127462  5.660959842
#> log_lambda_3  4.711888036  4.731794214  4.751457468  4.766440325  4.782358969
#> log_lambda_4  3.787579852  3.801124244  3.813926070  3.824160766  3.834755176
#> log_lambda_5  4.876618333  4.887184861  4.896907283  4.904306302  4.912113218
#> log_lambda_6  5.347935851  5.370092803  5.390164900  5.404846279  5.419759332
#> alpha_1_1     0.820572634  0.818816292  0.817115536  0.815737717  0.814300732
#> alpha_1_2     0.009079257  0.007326724  0.005617211  0.004251804  0.002841209
#> alpha_1_3    -0.096929917 -0.098729134 -0.100468245 -0.101941265 -0.103383933
#> alpha_1_4    -0.546600020 -0.549474862 -0.552122676 -0.554441011 -0.556674556
#> alpha_1_5     0.044568963  0.043408652  0.042296707  0.041475844  0.040539528
#> alpha_1_6     0.039748493  0.038057580  0.036444548  0.035272104  0.033959892
#> alpha_2_2     0.799503676  0.791158079  0.782773038  0.776550826  0.769969386
#> alpha_2_3    -0.284884995 -0.287025691 -0.289003496 -0.290670174 -0.292325200
#> alpha_2_4    -0.047487169 -0.049242883 -0.050967717 -0.052366793 -0.053767605
```

```
#> alpha_2_5     0.033972147  0.032127519  0.030294723  0.028978720  0.027563459
#> alpha_2_6    -0.123349924 -0.127501020 -0.131548525 -0.134712084 -0.137850616
#> alpha_3_3     1.178017147  1.174321693  1.170278466  1.167478357  1.164294476
#> alpha_3_4     0.070031367  0.068861205  0.067772611  0.066815285  0.065900292
#> alpha_3_5     0.014709409  0.013243097  0.011895974  0.010822271  0.009714988
#> alpha_3_6    -0.023778268 -0.026771094 -0.029581443 -0.031763708 -0.034044195
#> alpha_4_4     1.043352490  1.042020344  1.040822627  1.039889713  1.038847402
#> alpha_4_5     0.036131220  0.035236415  0.034377949  0.033778741  0.033064906
#> alpha_4_6    -0.007544810 -0.009642285 -0.011640181 -0.013220734 -0.014830128
#> alpha_5_5     0.510655649  0.508814605  0.507265008  0.506053867  0.504805857
#> alpha_5_6     .            .            .            .            .
#> alpha_6_6     0.547989276  0.543784100  0.540352842  0.538172784  0.535963519
#>
#> (Intercept)   .
#> log_lambda_1  4.230335018
#> log_lambda_2  5.683970887
#> log_lambda_3  4.797757367
#> log_lambda_4  3.844489682
#> log_lambda_5  4.919842386
#> log_lambda_6  5.434774974
#> alpha_1_1     0.813012391
#> alpha_1_2     0.001569683
#> alpha_1_3    -0.104694307
#> alpha_1_4    -0.558700449
#> alpha_1_5     0.039665915
#> alpha_1_6     0.032726800
#> alpha_2_2     0.763518819
#> alpha_2_3    -0.293917204
#> alpha_2_4    -0.055047573
#> alpha_2_5     0.026227987
#> alpha_2_6    -0.140863188
#> alpha_3_3     1.161221563
#> alpha_3_4     0.065057299
#> alpha_3_5     0.008619305
#> alpha_3_6    -0.036270818
#> alpha_4_4     1.037896220
#> alpha_4_5     0.032416036
#> alpha_4_6    -0.016324373
#> alpha_5_5     0.503458708
#> alpha_5_6     .
#> alpha_6_6     0.533474729
```