Herma líkan með hárri þáttafylgni úr meistaraverkefni Ólafar

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Líkan með þáttafylgni 0,96

Hér bý ég til þýðislíkanið og úrvinnslulíkanið.

```
popModel <- "
    LEB =~ 0.4*leb01 + 0.4*leb05 + 0.4*leb08 + 0.4*leb12 + 0.4*leb13 +
           0.4*leb14 + 0.3*leb15 + 0.4*leb19 + 0.5*leb29 + 0.3*leb31 +
           0.2*leb32 + 0.3*leb36 + 0.3*leb38 + 0.5*leb39 + 0.4*leb43
    LEC =~ 0.5*lec02 + 0.3*lec03 + 0.2*lec04 + 0.4*lec06 + 0.5*lec07 +
           0.4*lec11 + 0.4*lec16 + 0.5*lec17 + 0.02*lec18 + 0.1*lec25 +
           0.3*lec26 + 0.4*lec27 + 0.4*lec30 + 0.4*lec33 + 0.4*lec35 +
           0.3*lec37
   LED =~  0.3*led09 + 0.4*led28 + 0.2*led40 + 0.4*led41 + 0.5*led42
   LEE =~  0.3*lee10 + 0.3*lee20 + 0.4*lee34 + 0.4*lee44

   LEB ~~ 0.960*LEC + 0.960*LED + 0.960*LEE
   LEC ~~ 0.960*LED + 0.960*LEE
   LED ~~ 0.960*LEE

   LEB ~~ 1*LEB
   LEC ~~ 1*LEC
   LED ~~ 1*LED
   LEE ~~ 1*LEE

   leb01 ~~ 0.84*leb01
   leb05 ~~ 0.84*leb05
   leb08 ~~ 0.84*leb08
   leb12 ~~ 0.84*leb12
   leb13 ~~ 0.84*leb13
   leb14 ~~ 0.84*leb14
   leb15 ~~ 0.91*leb15
   leb19 ~~ 0.84*leb19
   leb29 ~~ 0.75*leb29
   leb31 ~~ 0.91*leb31
   leb32 ~~ 0.96*leb32
   leb36 ~~ 0.91*leb36
   leb38 ~~ 0.91*leb38
   leb39 ~~ 0.75*leb39
   leb43 ~~ 0.84*leb43

   lec02 ~~ 0.75*lec02
```

```
    lec03 ~~ 0.91*lec03
    lec04 ~~ 0.96*lec04
    lec06 ~~ 0.84*lec06
    lec07 ~~ 0.75*lec07
    lec11 ~~ 0.84*lec11
    lec16 ~~ 0.84*lec16
    lec17 ~~ 0.75*lec17
    lec18 ~~ 0.9996*lec18
    lec25 ~~ 0.99*lec25
    lec26 ~~ 0.91*lec26
    lec27 ~~ 0.84*lec27
    lec30 ~~ 0.84*lec30
    lec33 ~~ 0.84*lec33
    lec35 ~~ 0.84*lec35
    lec37 ~~ 0.91*lec37

    led09 ~~ 0.91*led09
    led28 ~~ 0.84*led28
    led40 ~~ 0.96*led40
    led41 ~~ 0.84*led41
    led42 ~~ 0.75*led42

    lee10 ~~ 0.91*lee10
    lee20 ~~ 0.91*lee20
    lee34 ~~ 0.84*lee34
    lee44 ~~ 0.84*lee44
"


analyzeModel <- "
    LEB =~ leb01 + leb05 + leb08 + leb12 + leb13 +
           leb14 + leb15 + leb19 + leb29 + leb31 +
           leb32 + leb36 + leb38 + leb39 + leb43
    LEC =~ lec02 + lec03 + lec04 + lec06 + lec07 +
           lec11 + lec16 + lec17 + lec18 + lec25 +
           lec26 + lec27 + lec30 + lec33 + lec35 +
           lec37
   LED =~  led09 + led28 + led40 + led41 + led42
   LEE =~  lee10 + lee20 + lee34 + lee44
"
```

Síðan læt ég lavaan spýta þýðislíkaninu út aftur til að sjá hvort ég hef gert þetta rétt og fæ mynd einnig til staðfestingar.

```
pop.fit <- cfa(popModel, fixed.x = FALSE)
summary(pop.fit, standardized = TRUE, rsquare = TRUE)


## lavaan 0.6-7 did not run (perhaps do.fit = FALSE)?
## ** WARNING ** Estimates below are simply the starting values
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of free parameters                          0
##
```

```
##    Number of observations                           0
##
##
## Parameter Estimates:
##
##
## Latent Variables:
##                   Estimate   Std.lv  Std.all
##   LEB =~
##     leb01            0.400    0.400    0.400
##     leb05            0.400    0.400    0.400
##     leb08            0.400    0.400    0.400
##     leb12            0.400    0.400    0.400
##     leb13            0.400    0.400    0.400
##     leb14            0.400    0.400    0.400
##     leb15            0.300    0.300    0.300
##     leb19            0.400    0.400    0.400
##     leb29            0.500    0.500    0.500
##     leb31            0.300    0.300    0.300
##     leb32            0.200    0.200    0.200
##     leb36            0.300    0.300    0.300
##     leb38            0.300    0.300    0.300
##     leb39            0.500    0.500    0.500
##     leb43            0.400    0.400    0.400
##   LEC =~
##     lec02            0.500    0.500    0.500
##     lec03            0.300    0.300    0.300
##     lec04            0.200    0.200    0.200
##     lec06            0.400    0.400    0.400
##     lec07            0.500    0.500    0.500
##     lec11            0.400    0.400    0.400
##     lec16            0.400    0.400    0.400
##     lec17            0.500    0.500    0.500
##     lec18            0.020    0.020    0.020
##     lec25            0.100    0.100    0.100
##     lec26            0.300    0.300    0.300
##     lec27            0.400    0.400    0.400
##     lec30            0.400    0.400    0.400
##     lec33            0.400    0.400    0.400
##     lec35            0.400    0.400    0.400
##     lec37            0.300    0.300    0.300
##   LED =~
##     led09            0.300    0.300    0.300
##     led28            0.400    0.400    0.400
##     led40            0.200    0.200    0.200
##     led41            0.400    0.400    0.400
##     led42            0.500    0.500    0.500
##   LEE =~
##     lee10            0.300    0.300    0.300
##     lee20            0.300    0.300    0.300
##     lee34            0.400    0.400    0.400
##     lee44            0.400    0.400    0.400
##
## Covariances:
```

```
##                     Estimate   Std.lv  Std.all
##   LEB ~~
##     LEC              0.960    0.960    0.960
##     LED              0.960    0.960    0.960
##     LEE              0.960    0.960    0.960
##   LEC ~~
##     LED              0.960    0.960    0.960
##     LEE              0.960    0.960    0.960
##   LED ~~
##     LEE              0.960    0.960    0.960
##
## Variances:
##                     Estimate   Std.lv  Std.all
##     LEB              1.000    1.000    1.000
##     LEC              1.000    1.000    1.000
##     LED              1.000    1.000    1.000
##     LEE              1.000    1.000    1.000
##    .leb01            0.840    0.840    0.840
##    .leb05            0.840    0.840    0.840
##    .leb08            0.840    0.840    0.840
##    .leb12            0.840    0.840    0.840
##    .leb13            0.840    0.840    0.840
##    .leb14            0.840    0.840    0.840
##    .leb15            0.910    0.910    0.910
##    .leb19            0.840    0.840    0.840
##    .leb29            0.750    0.750    0.750
##    .leb31            0.910    0.910    0.910
##    .leb32            0.960    0.960    0.960
##    .leb36            0.910    0.910    0.910
##    .leb38            0.910    0.910    0.910
##    .leb39            0.750    0.750    0.750
##    .leb43            0.840    0.840    0.840
##    .lec02            0.750    0.750    0.750
##    .lec03            0.910    0.910    0.910
##    .lec04            0.960    0.960    0.960
##    .lec06            0.840    0.840    0.840
##    .lec07            0.750    0.750    0.750
##    .lec11            0.840    0.840    0.840
##    .lec16            0.840    0.840    0.840
##    .lec17            0.750    0.750    0.750
##    .lec18            1.000    1.000    1.000
##    .lec25            0.990    0.990    0.990
##    .lec26            0.910    0.910    0.910
##    .lec27            0.840    0.840    0.840
##    .lec30            0.840    0.840    0.840
##    .lec33            0.840    0.840    0.840
##    .lec35            0.840    0.840    0.840
##    .lec37            0.910    0.910    0.910
##    .led09            0.910    0.910    0.910
##    .led28            0.840    0.840    0.840
##    .led40            0.960    0.960    0.960
##    .led41            0.840    0.840    0.840
##    .led42            0.750    0.750    0.750
##    .lee10            0.910    0.910    0.910
```

```
##     .lee20                     0.910    0.910    0.910
##     .lee34                     0.840    0.840    0.840
##     .lee44                     0.840    0.840    0.840
##
## R-Square:
##                             Estimate
##     leb01                     0.160
##     leb05                     0.160
##     leb08                     0.160
##     leb12                     0.160
##     leb13                     0.160
##     leb14                     0.160
##     leb15                     0.090
##     leb19                     0.160
##     leb29                     0.250
##     leb31                     0.090
##     leb32                     0.040
##     leb36                     0.090
##     leb38                     0.090
##     leb39                     0.250
##     leb43                     0.160
##     lec02                     0.250
##     lec03                     0.090
##     lec04                     0.040
##     lec06                     0.160
##     lec07                     0.250
##     lec11                     0.160
##     lec16                     0.160
##     lec17                     0.250
##     lec18                     0.000
##     lec25                     0.010
##     lec26                     0.090
##     lec27                     0.160
##     lec30                     0.160
##     lec33                     0.160
##     lec35                     0.160
##     lec37                     0.090
##     led09                     0.090
##     led28                     0.160
##     led40                     0.040
##     led41                     0.160
##     led42                     0.250
##     lee10                     0.090
##     lee20                     0.090
##     lee34                     0.160
##     lee44                     0.160
```
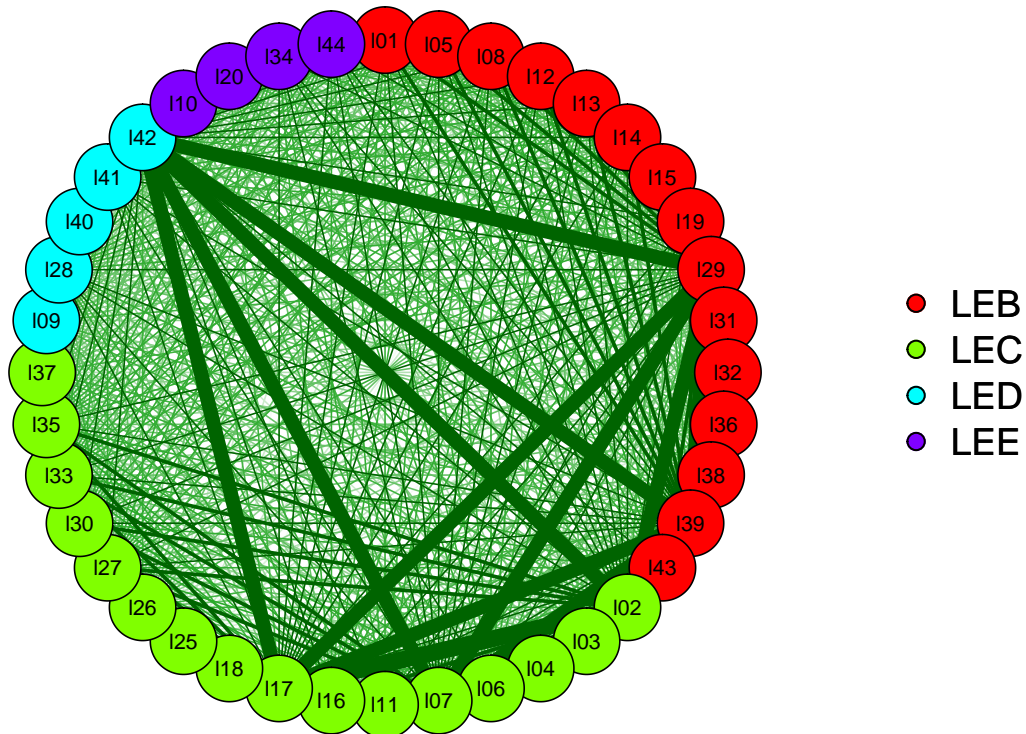
```r
pop.cov <- fitted(pop.fit)$cov
semPlot::semPaths(pop.fit, "std", edge.label.cex = 0.8, layout= 'circle2', sizeMan= 4, style= 'lisrel')
```
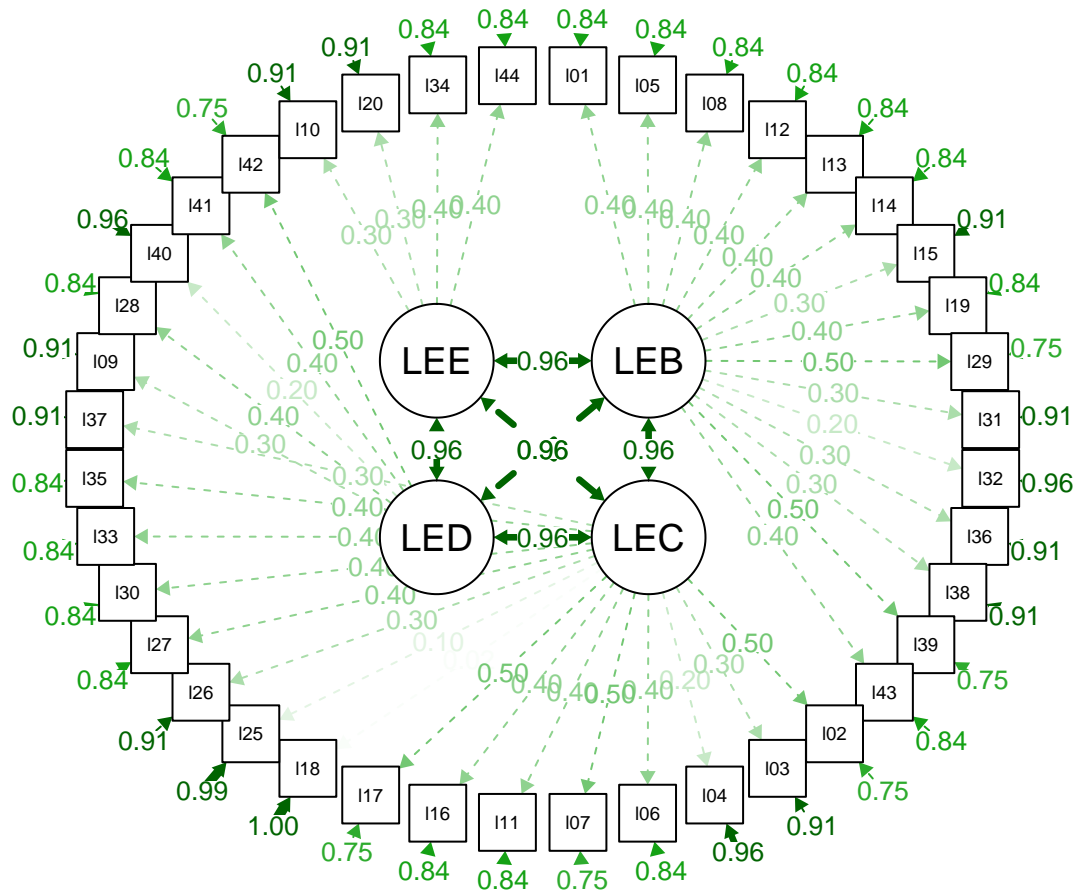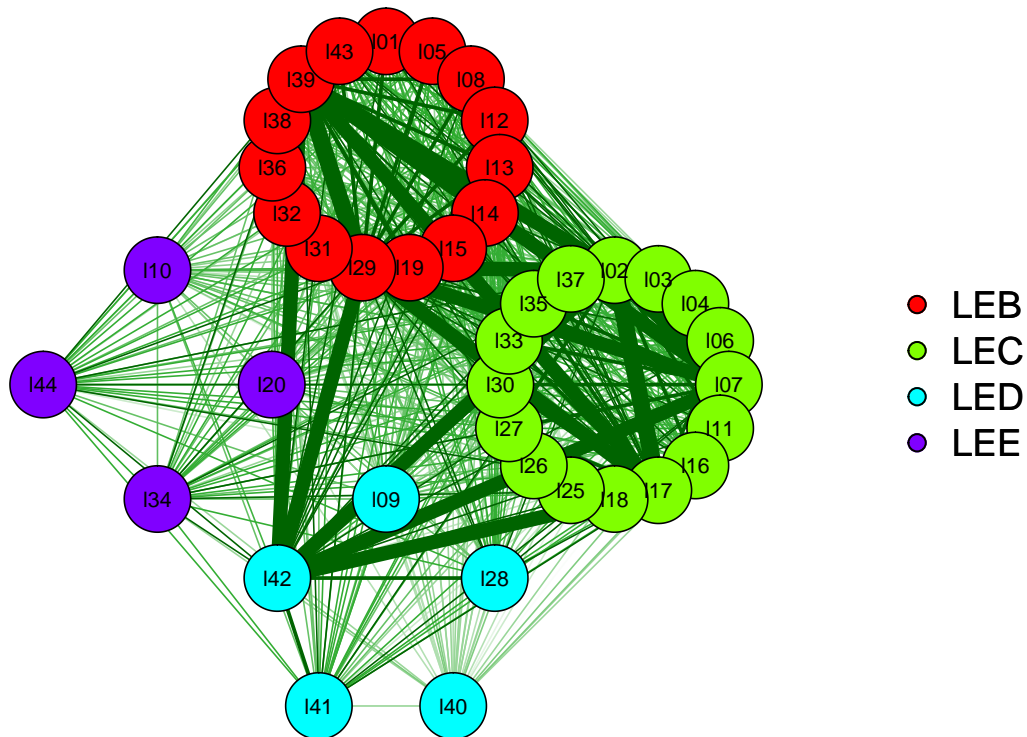
```
corrplot::corrplot(cov2cor(pop.cov), method= 'ellipse',diag= FALSE, tl.cex= 0.6)
```
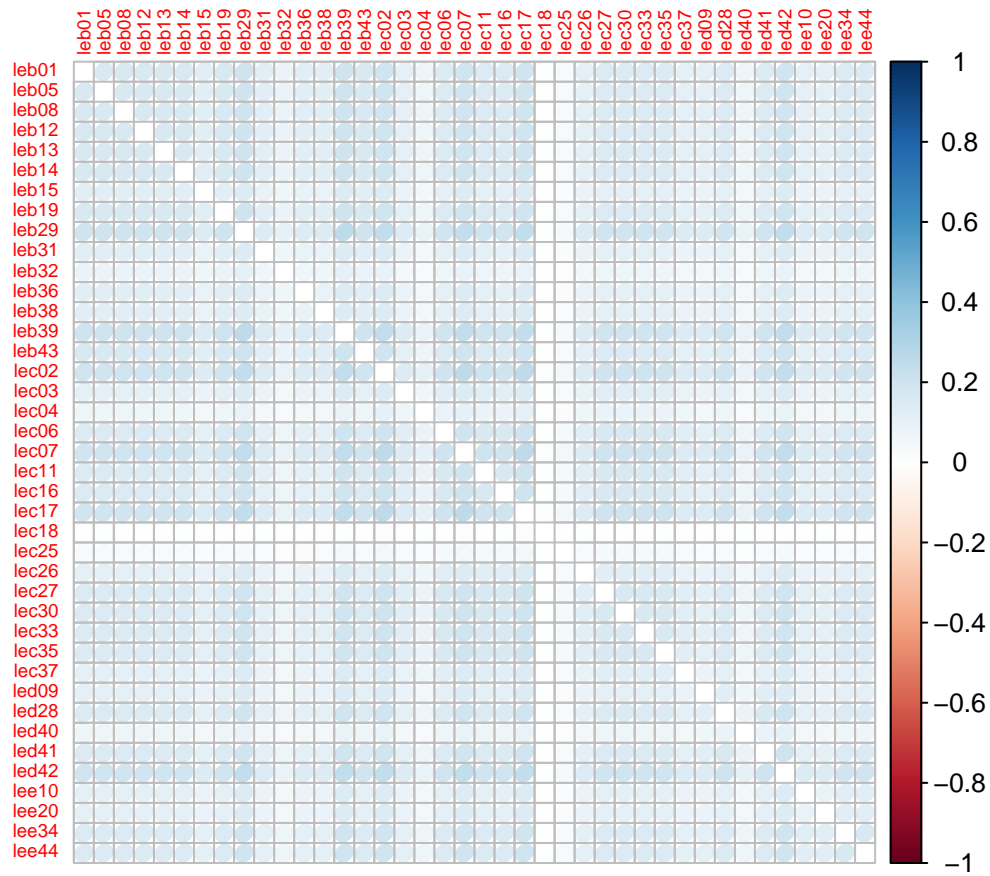
```
qgraph::qgraph(cov2cor(pop.cov), groups= list(LEB= 1:15, LEC= 16:31, LED= 32:36, LEE= 37:40), layout= 'c
```

```
qgraph::qgraph(cov2cor(pop.cov), groups= list(LEB= 1:15, LEC= 16:31, LED= 32:36, LEE= 37:40))
```


Þetta virðist líta svo ljómandi vel út, allt eins og það á að vera a.m.k. við snögga athugun.

```
tic()
Output <- sim(10^3, analyzeModel, n=10^4, generate=popModel, lavaanfun = "cfa", std.lv = TRUE, multicore
```

```
## Progress tracker is not available when 'multicore' is TRUE.
```

```
# summary(Output)
toc()
```

```
## 106.552 sec elapsed
```

```
summaryConverge(Output)
```

```
## $Converged
##     num.converged num.nonconverged
##               893              107
##
## $'Nonconvergent Reasons'
##                                                                       count
## Nonconvergent                                                             0
## Improper SE                                                               0
## Improper Variance                                                         0
## Improper Correlation                                                      0
## Not-positive-definite model-implied covariance matrix of latent variables   107
## Optimal estimates were not guaranteed                                     0
```

8

```r
getCutoff(Output, alpha= c(0.05, 0.50, 0.95)) %>% round(3)
```

```
##       chisq      aic      bic rmsea   cfi   tli  srmr
## 95% 797.502 1097502 1098122 0.003 0.998 0.998 0.009
## 50% 736.071 1096042 1096662 0.001 1.000 1.000 0.008
## 5%  675.926 1094593 1095213 0.000 1.000 1.002 0.008
```

```r
summaryParam(Output, improper= FALSE, detail= TRUE, digits= 3) %>%
    select('Estimate Average', 'Average Param', 'Rel Bias', 'Estimate SD', 'Average SE', 'Rel SE Bias')
    filter(abs('Rel Bias') >= 0.1 | abs('Rel SE Bias') >= 0.1)
```

```
##          Estimate Average Average Param Rel Bias Estimate SD Average SE
## LEB~~LEE            0.958          0.96   -0.002       0.015      0.017
##           Rel SE Bias
## LEB~~LEE        0.109
```

```r
coef(Output) %>%
  dplyr::select('LEB~~LEC':'LED~~LEE') %>%
  pivot_longer('LEB~~LEC':'LED~~LEE') %>%
  ggplot(aes(y = value, x = name)) +
  geom_violin()
```
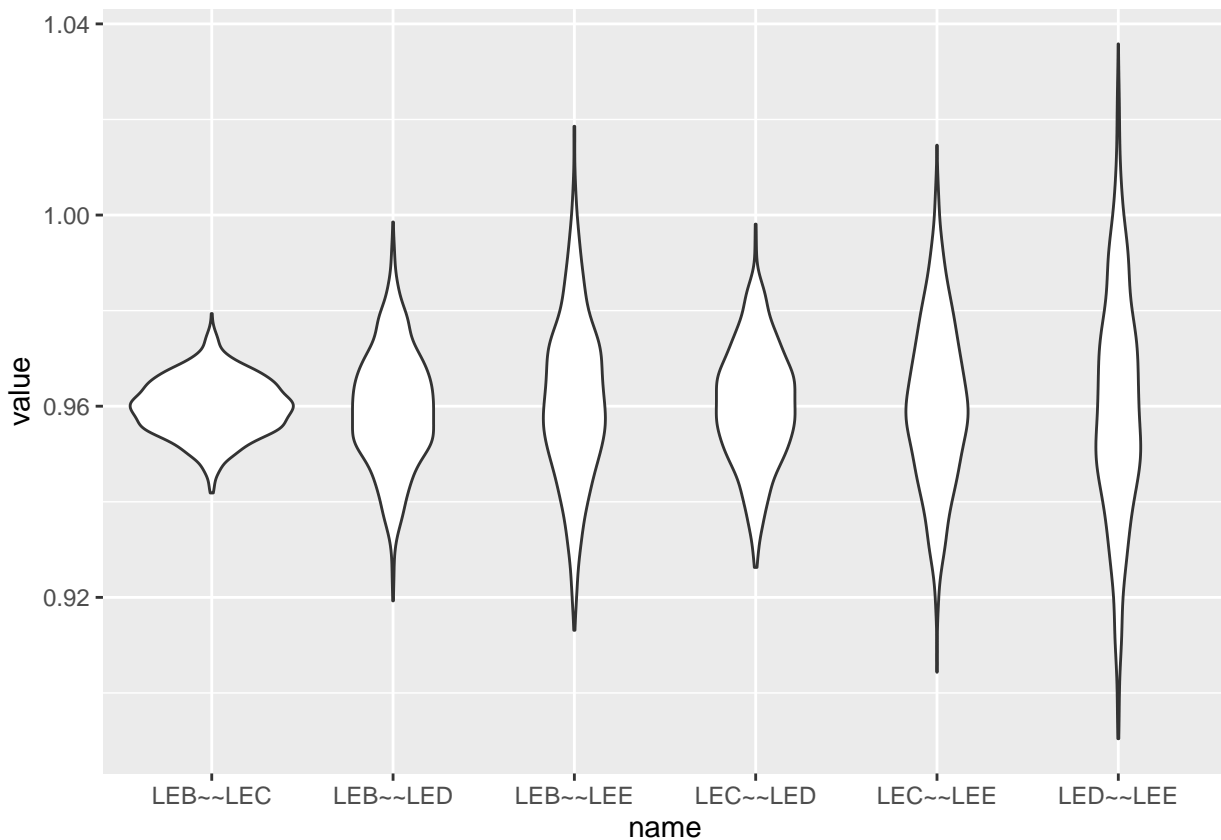


```r
tmp.num <- dplyr::select(coef(Output), 'LEB~~LEC':'LED~~LEE') %>%
  rowwise() %>%
```

```
  dplyr::transmute(max = max(c('LEB~~LEC', 'LEB~~LED', 'LEB~~LEE', 'LEC~~LED', 'LEC~~LEE', 'LED~~LEE'))]
  pull(var = "max") > 1
table(tmp.num)
```

```
## tmp.num
## FALSE  TRUE
##   936    64
```

Þáttafylgni 0,98

Eftirfarandi byggist á því að þáttafylgnin í `popModel` sé tilgreind sem 0.960, þ.e. með þremur aukastöfum.

```
popModel_0.98 <- gsub("0.960", "0.980", popModel, fixed = TRUE) # Hækka þáttafylgnina

tic()
Output_0.98 <- sim(10^3, analyzeModel, n = 10^4, generate = popModel_0.98, lavaanfun = "cfa",
                   std.lv = TRUE, multicore = TRUE, numProc = parallel::detectCores() - 2)
```

```
## Progress tracker is not available when 'multicore' is TRUE.
```

```
# summary(Output)
toc()
```

```
## 102.392 sec elapsed
```

```
summaryConverge(Output_0.98)
```

```
## $Converged
##    num.converged num.nonconverged
##              561              439
##
## $'Nonconvergent Reasons'
##                                                                          count
## Nonconvergent                                                                0
## Improper SE                                                                  0
## Improper Variance                                                            0
## Improper Correlation                                                         0
## Not-positive-definite model-implied covariance matrix of latent variables 439
## Optimal estimates were not guaranteed                                        0
```

```
getCutoff(Output_0.98, alpha = c(0.05, 0.50, 0.95)) %>% round(3)
```

```
##         chisq     aic     bic rmsea   cfi   tli  srmr
## 95% 794.197 1096785 1097405 0.003 0.998 0.998 0.008
## 50% 736.571 1095315 1095936 0.001 1.000 1.000 0.008
## 5%  674.234 1093867 1094487 0.000 1.000 1.002 0.008
```

```
summaryParam(Output_0.98, improper= FALSE, detail= TRUE, digits= 3) %>%
    select('Estimate Average', 'Average Param', 'Rel Bias', 'Estimate SD', 'Average SE', 'Rel SE Bias')
    filter(abs('Rel Bias') >= 0.1 | abs('Rel SE Bias') >= 0.1)
```

```
##           Estimate Average Average Param Rel Bias Estimate SD Average SE
## LEB~~LED             0.976          0.98   -0.004       0.010      0.012
## LEB~~LEE             0.973          0.98   -0.007       0.013      0.017
## LEC~~LED             0.976          0.98   -0.004       0.010      0.012
## LEC~~LEE             0.972          0.98   -0.008       0.013      0.016
## LED~~LEE             0.967          0.98   -0.013       0.016      0.022
##           Rel SE Bias
## LEB~~LED        0.211
## LEB~~LEE        0.275
## LEC~~LED        0.192
## LEC~~LEE        0.256
## LED~~LEE        0.369
```

```
coef(Output_0.98) %>%
  dplyr::select('LEB~~LEC':'LED~~LEE') %>%
  pivot_longer('LEB~~LEC':'LED~~LEE') %>%
  ggplot(aes(y = value, x = name)) +
  geom_violin()
```
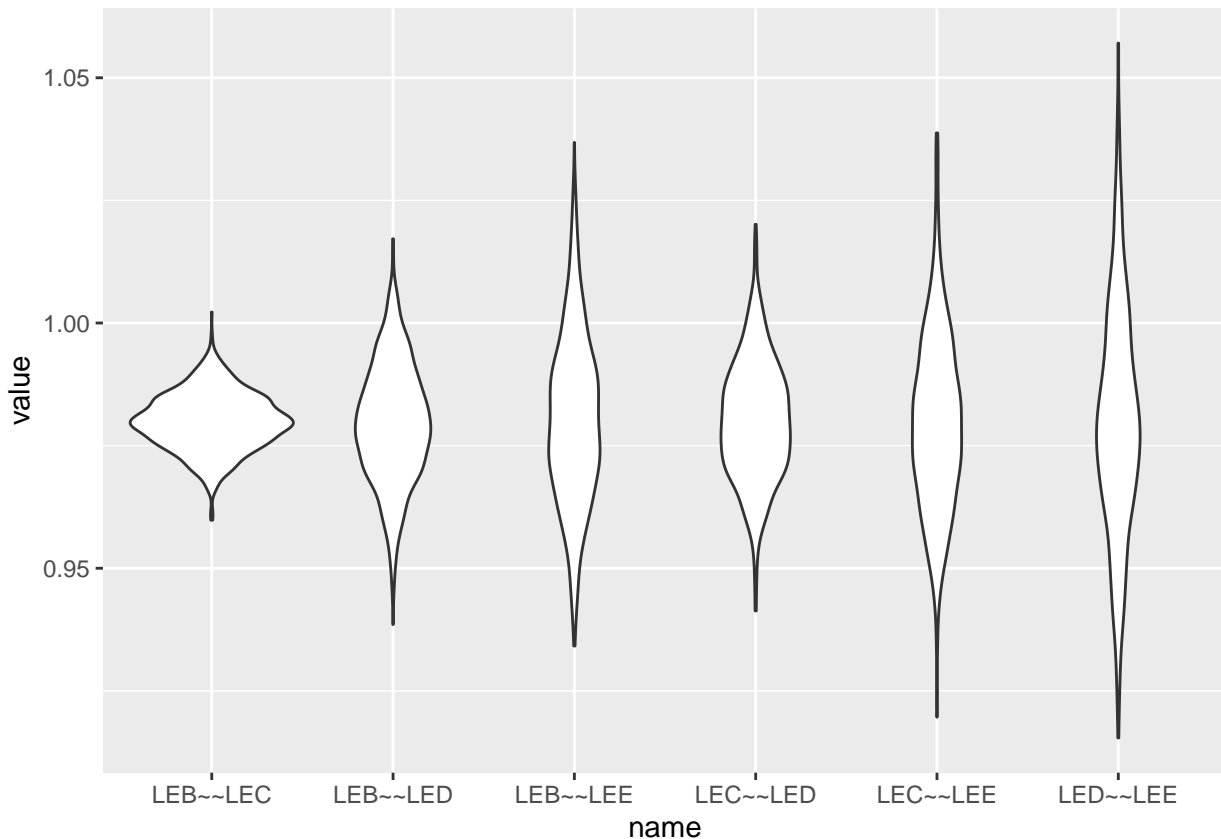


```
tmp.num <- dplyr::select(coef(Output_0.98), 'LEB~~LEC':'LED~~LEE') %>%
  rowwise() %>%
```

11

```
  dplyr::transmute(max = max(c(`LEB~~LEC`, `LEB~~LED`, `LEB~~LEE`, `LEC~~LED`, `LEC~~LEE`, `LED~~LEE`))]
  pull(var = "max") > 1
table(tmp.num)
```

```
## tmp.num
## FALSE  TRUE
##   669   331
```