

# MetaSEM Analysis /NA

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- Notes:
  - Link: <http://openmx.psyc.virginia.edu/thread/4153>
  - The models displayed here may not be the best fitted models.

```
library(metaSEM)

s= read.csv("H.csv", head= TRUE)
s1=as.data.frame(na.omit(s))
H=cor(s1, use="complete.obs", method="pearson")
s= read.csv("R.csv", head= TRUE)
s2=as.data.frame(na.omit(s))
R=cor(s2, use="complete.obs", method="pearson")
s= read.csv("U.csv", head= TRUE)
s3=as.data.frame(na.omit(s))
U=cor(s3, use="complete.obs", method="pearson")
s= read.csv("T.csv", head= TRUE)
s4=as.data.frame(na.omit(s))
T=cor(s4, use="complete.obs", method="pearson")

v=c(115, 305, 136, 296)
corrlist <- list(H, R, U, T)

fixed1 <- tssem1(corrlist, v, method="FEM")
## Rerun it to remove code 6 (error code)
fixed1 <- rerun(fixed1)
summary(fixed1)

##
## Call:
## tssem1FEM(my.df = my.df, n = n, cor.analysis = cor.analysis,
##   model.name = model.name, cluster = cluster, suppressWarnings = suppressWarnings,
##   silent = silent, run = run)
##
## Coefficients:
##           Estimate Std.Error z value Pr(>|z|)
## S[1,2]    0.211793  0.032930  6.4316 1.263e-10 ***
## S[1,3]    0.321403  0.030856 10.4163 < 2.2e-16 ***
## S[1,4]    0.062929  0.034648  1.8162  0.06934 .
## S[1,5]    0.177599  0.033190  5.3509 8.751e-08 ***
## S[1,6]    0.240152  0.032322  7.4301 1.086e-13 ***
## S[1,7]    0.369507  0.029884 12.3649 < 2.2e-16 ***
## S[1,8]    0.487736  0.026267 18.5685 < 2.2e-16 ***
## S[1,9]    0.557593  0.023743 23.4846 < 2.2e-16 ***
## S[1,10]   0.541918  0.024389 22.2202 < 2.2e-16 ***
## S[2,3]    0.383330  0.029520 12.9855 < 2.2e-16 ***
## S[2,4]    0.439715  0.027829 15.8008 < 2.2e-16 ***
## S[2,5]   -0.021909  0.034541 -0.6343  0.52589
## S[2,6]    0.228719  0.032819  6.9692 3.188e-12 ***
```

```

## S[2,7] 0.193679 0.033453 5.7896 7.054e-09 ***
## S[2,8] 0.345064 0.030554 11.2935 < 2.2e-16 ***
## S[2,9] 0.369924 0.029988 12.3358 < 2.2e-16 ***
## S[2,10] 0.299802 0.031717 9.4523 < 2.2e-16 ***
## S[3,4] 0.339855 0.031798 10.6880 < 2.2e-16 ***
## S[3,5] 0.077816 0.034203 2.2751 0.02290 *
## S[3,6] 0.288582 0.031566 9.1422 < 2.2e-16 ***
## S[3,7] 0.306545 0.031447 9.7481 < 2.2e-16 ***
## S[3,8] 0.446161 0.027692 16.1117 < 2.2e-16 ***
## S[3,9] 0.490088 0.026359 18.5926 < 2.2e-16 ***
## S[3,10] 0.474881 0.026715 17.7759 < 2.2e-16 ***
## S[4,5] -0.051293 0.034206 -1.4995 0.13374
## S[4,6] 0.205368 0.033341 6.1596 7.294e-10 ***
## S[4,7] 0.067824 0.034294 1.9777 0.04796 *
## S[4,8] 0.226451 0.033029 6.8560 7.079e-12 ***
## S[4,9] 0.191349 0.033954 5.6355 1.745e-08 ***
## S[4,10] 0.159843 0.034973 4.5705 4.866e-06 ***
## S[5,6] 0.402685 0.029010 13.8811 < 2.2e-16 ***
## S[5,7] 0.349730 0.030451 11.4850 < 2.2e-16 ***
## S[5,8] 0.208754 0.033180 6.2915 3.145e-10 ***
## S[5,9] 0.194353 0.033312 5.8343 5.402e-09 ***
## S[5,10] 0.240967 0.032409 7.4352 1.044e-13 ***
## S[6,7] 0.414614 0.028753 14.4197 < 2.2e-16 ***
## S[6,8] 0.424010 0.028256 15.0058 < 2.2e-16 ***
## S[6,9] 0.394958 0.029211 13.5207 < 2.2e-16 ***
## S[6,10] 0.444970 0.027620 16.1104 < 2.2e-16 ***
## S[7,8] 0.550889 0.024407 22.5708 < 2.2e-16 ***
## S[7,9] 0.551348 0.024321 22.6701 < 2.2e-16 ***
## S[7,10] 0.508123 0.025814 19.6839 < 2.2e-16 ***
## S[8,9] 0.731315 0.016059 45.5395 < 2.2e-16 ***
## S[8,10] 0.683972 0.018319 37.3363 < 2.2e-16 ***
## S[9,10] 0.712989 0.016928 42.1187 < 2.2e-16 ***
## ---
## Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Goodness-of-fit indices:
##
## Value
## Sample size 852.0000
## Chi-square of target model 487.6510
## DF of target model 135.0000
## p value of target model 0.0000
## Chi-square of independence model 3723.8717
## DF of independence model 180.0000
## RMSEA 0.1108
## RMSEA lower 95% CI 0.1005
## RMSEA upper 95% CI 0.1217
## SRMR 0.1439
## TLI 0.8673
## CFI 0.9005
## AIC 217.6510
## BIC -423.2732
## OpenMx status1: 0 ("0" or "1": The optimization is considered fine.
## Other values may indicate problems.)

```

```
coef(fixed1)
```

```
##           H           L           O           F           P           C
## H 1.00000000  0.21179333  0.32140298  0.06292869  0.17759937  0.2401518
## L 0.21179333  1.00000000  0.38332956  0.43971475 -0.02190891  0.2287189
## O 0.32140298  0.38332956  1.00000000  0.33985468  0.07781551  0.2885819
## F 0.06292869  0.43971475  0.33985468  1.00000000 -0.05129266  0.2053682
## P 0.17759937 -0.02190891  0.07781551 -0.05129266  1.00000000  0.4026854
## C 0.24015184  0.22871888  0.28858185  0.20536824  0.40268540  1.0000000
## E 0.36950744  0.19367873  0.30654457  0.06782411  0.34973010  0.4146143
## I 0.48773555  0.34506421  0.44616135  0.22645117  0.20875403  0.4240099
## M 0.55759281  0.36992380  0.49008772  0.19134852  0.19435324  0.3949576
## A 0.54191778  0.29980203  0.47488115  0.15984345  0.24096749  0.4449697
##           E           I           M           A
## H 0.36950744  0.4877355  0.5575928  0.5419178
## L 0.19367873  0.3450642  0.3699238  0.2998020
## O 0.30654457  0.4461613  0.4900877  0.4748811
## F 0.06782411  0.2264512  0.1913485  0.1598435
## P 0.34973010  0.2087540  0.1943532  0.2409675
## C 0.41461429  0.4240099  0.3949576  0.4449697
## E 1.00000000  0.5508889  0.5513485  0.5081227
## I 0.55088892  1.0000000  0.7313148  0.6839717
## M 0.55134848  0.7313148  1.0000000  0.7129891
## A 0.50812274  0.6839717  0.7129891  1.0000000
```

```
A1 <- create.mxMatrix(c(0, "1*H2L", "1*H2O", "0*H2F", "0*H2P", "0*H2C", "0*H2E", "1*H2I",
                        "1*H2M", "1*H2A", 0, 0, "1*L2O", "1*L2F", "0*L2P", "1*L2C",
                        "1*L2E", "1*L2I", "1*L2M", "-1*L2A", 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
                        "1*O2M", "1*O2A", 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, "-1*F2M", "-1*F2A",
                        0, 0, 0, 0, 0, 0, 0, 0, "1*P2M", "1*P2A", 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
                        "1*C2M", "1*C2A", 0, 0, 0, 0, 0, 0, 0, 0, "1*E2M", "1*E2A",
                        0, 0, 0, 0, 0, 0, 0, 0, "1*I2M", "1*I2A", 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
                        "1*M2A", 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0),
                      type="Full", ncol=10, nrow=10, as.mxMatrix=FALSE)
dimnames(A1) <- dimnames(corrlist[[1]])
## Check A1
A1
```

```
## H L O F P C E I
## H "0" "0" "0" "0" "0" "0" "0" "0"
## L "1*H2L" "0" "0" "0" "0" "0" "0" "0"
## O "1*H2O" "1*L2O" "0" "0" "0" "0" "0" "0"
## F "0*H2F" "1*L2F" "0" "0" "0" "0" "0" "0"
## P "0*H2P" "0*L2P" "0" "0" "0" "0" "0" "0"
## C "0*H2C" "1*L2C" "0" "0" "0" "0" "0" "0"
## E "0*H2E" "1*L2E" "0" "0" "0" "0" "0" "0"
## I "1*H2I" "1*L2I" "0" "0" "0" "0" "0" "0"
## M "1*H2M" "1*L2M" "1*O2M" "-1*F2M" "1*P2M" "1*C2M" "1*E2M" "1*I2M"
## A "1*H2A" "-1*L2A" "1*O2A" "-1*F2A" "1*P2A" "1*C2A" "1*E2A" "1*I2A"
## M A
## H "0" "0"
## L "0" "0"
## O "0" "0"
## F "0" "0"
## P "0" "0"
```

```

## C "0"      "0"
## E "0"      "0"
## I "0"      "0"
## M "0"      "0"
## A "1*M2A"  "0"

## Variance of H must be 1!!!
S1 <- create.mxMatrix(c(1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, "0*ErrVarL", 0, 0, 0, 0, 0, 0, 0,
                        "0*ErrVarO", 0, 0, 0, 0, "0*CovIO", 0, 0, "0*ErrVarF", 0, 0, 0,
                        "0*CovIF", 0, 0, "0*ErrVarP", "0*CovPC", "0*CovPE", "0*CovIP", 0, 0,
                        "0*ErrVarC", "0*CovCE", "0*CovIC", 0, 0, "0*ErrVarE", "0*CovIE", 0, 0,
                        "0*ErrVarI", 0, 0, "0*ErrVarM", 0, "0*ErrVarA"),
                      type="Symm", byrow=FALSE, as.mxMatrix=FALSE)
dimnames(S1) <- dimnames(corrlist[[1]])
## Check A1
S1

##   H   L           0           F           P           C
## H "1" "0"          "0"          "0"          "0"          "0"
## L "0" "0*ErrVarL" "0"          "0"          "0"          "0"
## O "0" "0"          "0*ErrVarO" "0"          "0"          "0"
## F "0" "0"          "0"          "0*ErrVarF" "0"          "0"
## P "0" "0"          "0"          "0"          "0*ErrVarP" "0*CovPC"
## C "0" "0"          "0"          "0"          "0*CovPC"  "0*ErrVarC"
## E "0" "0"          "0"          "0"          "0*CovPE"  "0*CovCE"
## I "0" "0"          "0*CovIO"   "0*CovIF"   "0*CovIP"   "0*CovIC"
## M "0" "0"          "0"          "0"          "0"          "0"
## A "0" "0"          "0"          "0"          "0"          "0"

##   E           I           M           A
## H "0"          "0"          "0"          "0"
## L "0"          "0"          "0"          "0"
## O "0"          "0*CovIO"   "0"          "0"
## F "0"          "0*CovIF"   "0"          "0"
## P "0*CovPE"   "0*CovIP"   "0"          "0"
## C "0*CovCE"   "0*CovIC"   "0"          "0"
## E "0*ErrVarE" "0*CovIE"   "0"          "0"
## I "0*CovIE"   "0*ErrVarI" "0"          "0"
## M "0"          "0"          "0*ErrVarM" "0"
## A "0"          "0"          "0"          "0*ErrVarA"

# fixed2 <- tssem2(fixed1, Amatrix=A1, Smatrix=S1, intervals.type="LB", diag.constraints=TRUE, mx.algebras=
fixed2 <- tssem2(fixed1, Amatrix=A1, Smatrix=S1,
mx.algebras=list( LRA=mxAlgebra(L2O*O2A+L2F*F2A+L2P*P2A+L2C*C2A+L2E*E2A+L2I*I2A+L2M*M2A,
                             name="LRA"),
                  OMA=mxAlgebra(O2M*M2A, name="OMA"), FMA=mxAlgebra(F2M*M2A, name="FMA"),
                  PMA=mxAlgebra(P2M*P2A, name="PMA"), CMA=mxAlgebra(C2M*C2A, name="CMA"),
                  EMA=mxAlgebra(E2M*M2A, name="EMA"), IMA=mxAlgebra(I2M*M2A, name="IMA"),
                  LOA=mxAlgebra(L2O*O2A, name="LOA"), LFA=mxAlgebra(L2F*F2A, name="LFA"),
                  LPA=mxAlgebra(L2P*P2A, name="LPA"), LCA=mxAlgebra(L2C*C2A, name="LCA"),
                  LEA=mxAlgebra(L2E*E2A, name="LEA"), LIA=mxAlgebra(L2I*I2A, name="LIA"),
                  LMA=mxAlgebra(L2M*M2A, name="LMA")))
## Rerun it to remove code 6 (error code)
fixed2 <- rerun(fixed2)
summary(fixed2)

```

```

##
## Call:
## wls(Cov = coef.tssem1FEM(tssem1.obj), asyCov = vcov.tssem1FEM(tssem1.obj),
##     n = sum(tssem1.obj$n), Amatrix = Amatrix, Smatrix = Smatrix,
##     Fmatrix = Fmatrix, diag.constraints = diag.constraints, cor.analysis = tssem1.obj$cor.analysis,
##     intervals.type = intervals.type, mx.algebras = mx.algebras,
##     model.name = model.name, suppressWarnings = suppressWarnings,
##     silent = silent, run = run)
##
## 95% confidence intervals: z statistic approximation
## Coefficients:
##      Estimate  Std.Error  lbound  ubound z value  Pr(>|z|)
## H2L  2.2562e-01  3.2972e-02  1.6100e-01  2.9025e-01  6.8429  7.763e-12
## H2O  2.8384e-01  3.5744e-02  2.1379e-01  3.5390e-01  7.9410  1.998e-15
## L2O  3.9334e-01  3.3931e-02  3.2683e-01  4.5984e-01  11.5921 < 2.2e-16
## H2F -2.8605e-02  3.5920e-02 -9.9006e-02  4.1797e-02 -0.7963  0.425835
## L2F  5.0625e-01  3.0504e-02  4.4647e-01  5.6604e-01  16.5963 < 2.2e-16
## H2P  2.0152e-01  3.4327e-02  1.3423e-01  2.6880e-01  5.8704  4.347e-09
## L2P -5.9404e-02  3.4984e-02 -1.2797e-01  9.1634e-03 -1.6980  0.089501
## H2C  2.2192e-01  3.5463e-02  1.5241e-01  2.9142e-01  6.2576  3.908e-10
## L2C  2.2341e-01  3.5364e-02  1.5409e-01  2.9272e-01  6.3172  2.663e-10
## H2E  3.7015e-01  3.2813e-02  3.0584e-01  4.3446e-01  11.2805 < 2.2e-16
## L2E  1.4391e-01  3.4625e-02  7.6048e-02  2.1178e-01  4.1563  3.235e-05
## H2I  4.5229e-01  2.8811e-02  3.9582e-01  5.0876e-01  15.6986 < 2.2e-16
## L2I  2.8138e-01  3.0764e-02  2.2108e-01  3.4168e-01  9.1464 < 2.2e-16
## H2M  2.1788e-01  2.6722e-02  1.6551e-01  2.7026e-01  8.1537  4.441e-16
## L2M  9.6338e-02  3.1298e-02  3.4996e-02  1.5768e-01  3.0781  0.002083
## O2M  1.3709e-01  2.6241e-02  8.5659e-02  1.8852e-01  5.2243  1.748e-07
## F2M -3.1850e-02  2.5611e-02 -8.2046e-02  1.8346e-02 -1.2436  0.213640
## P2M -1.8977e-02  2.4029e-02 -6.6073e-02  2.8118e-02 -0.7898  0.429660
## C2M  4.2779e-02  2.5858e-02 -7.9020e-03  9.3461e-02  1.6544  0.098052
## E2M  1.5892e-01  2.6819e-02  1.0636e-01  2.1148e-01  5.9258  3.109e-09
## I2M  4.3340e-01  2.7997e-02  3.7853e-01  4.8828e-01  15.4800 < 2.2e-16
## H2A  1.6156e-01  2.8599e-02  1.0550e-01  2.1761e-01  5.6490  1.613e-08
## L2A  3.6438e-05  3.2495e-02 -6.3653e-02  6.3726e-02  0.0011  0.999105
## O2A  1.1681e-01  2.7452e-02  6.3003e-02  1.7061e-01  4.2550  2.090e-05
## F2A -3.6506e-02  2.7026e-02 -8.9475e-02  1.6463e-02 -1.3508  0.176761
## P2A  2.3675e-02  2.4709e-02 -2.4754e-02  7.2105e-02  0.9582  0.337981
## C2A  1.1907e-01  2.6664e-02  6.6814e-02  1.7133e-01  4.4657  7.979e-06
## E2A  4.6353e-02  2.8256e-02 -9.0273e-03  1.0173e-01  1.6405  0.100905
## I2A  2.5288e-01  3.3397e-02  1.8742e-01  3.1834e-01  7.5719  3.686e-14
## M2A  3.1076e-01  3.5410e-02  2.4136e-01  3.8016e-01  8.7761 < 2.2e-16
## CovPC 3.7876e-01  2.7594e-02  3.2468e-01  4.3284e-01  13.7263 < 2.2e-16
## CovPE 2.8023e-01  2.8555e-02  2.2427e-01  3.3620e-01  9.8138 < 2.2e-16
## CovCE 2.7512e-01  2.7537e-02  2.2115e-01  3.2909e-01  9.9907 < 2.2e-16
## CovIO 1.1433e-01  2.2236e-02  7.0744e-02  1.5791e-01  5.1414  2.727e-07
## CovIF 3.9734e-02  2.2496e-02 -4.3577e-03  8.3825e-02  1.7663  0.077353
## CovIP 1.2910e-01  2.6962e-02  7.6254e-02  1.8194e-01  4.7882  1.683e-06
## CovIC 2.1510e-01  2.5402e-02  1.6531e-01  2.6488e-01  8.4678 < 2.2e-16
## CovIE 2.9929e-01  2.4449e-02  2.5138e-01  3.4721e-01  12.2417 < 2.2e-16
##
## H2L  ***
## H2O  ***
## L2O  ***

```

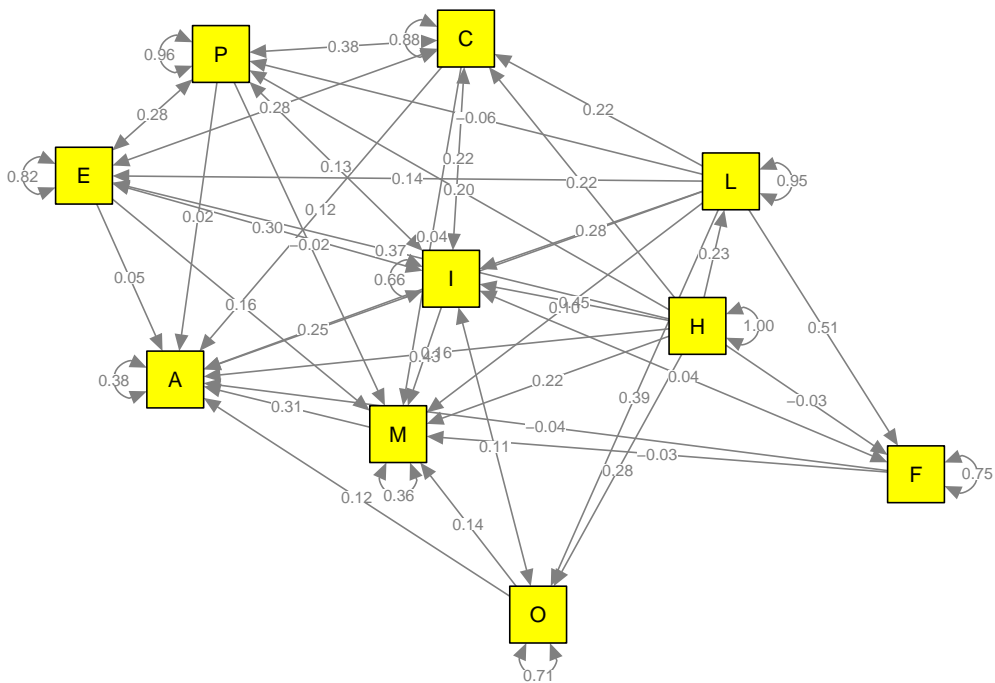
```

## H2F
## L2F ***
## H2P ***
## L2P .
## H2C ***
## L2C ***
## H2E ***
## L2E ***
## H2I ***
## L2I ***
## H2M ***
## L2M **
## O2M ***
## F2M
## P2M
## C2M .
## E2M ***
## I2M ***
## H2A ***
## L2A
## O2A ***
## F2A
## P2A
## C2A ***
## E2A
## I2A ***
## M2A ***
## CovPC ***
## CovPE ***
## CovCE ***
## CovIO ***
## CovIF .
## CovIP ***
## CovIC ***
## CovIE ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## mxAlgebras objects:
##      LRA      OMA      FMA      PMA      CMA
## 0.160422797 0.042602016 -0.009897693 -0.000449296 0.005093893
##      EMA      IMA      LOA      LFA      LPA
## 0.049386395 0.134684088 0.045944388 -0.018481299 -0.001406423
##      LCA      LEA      LIA      LMA
## 0.026601720 0.006670791 0.071155469 0.029938150
##
## Goodness-of-fit indices:
##
##                               Value
## Sample size                   852.0000
## Chi-square of target model    97.4068
## DF of target model            7.0000
## p value of target model       0.0000
## Number of constraints imposed on "Smatrix" 0.0000
## DF manually adjusted          0.0000

```

```
## Chi-square of independence model           3774.1312
## DF of independence model                   45.0000
## RMSEA                                     0.1232
## RMSEA lower 95% CI                       0.1022
## RMSEA upper 95% CI                       0.1455
## SRMR                                      0.0402
## TLI                                       0.8441
## CFI                                       0.9758
## AIC                                       83.4068
## BIC                                       50.1737
## OpenMx status1: 0 ("0" or "1": The optimization is considered fine.
## Other values indicate problems.)
```

```
library(semPlot)
my.plot <- meta2semPlot(fixed2, manNames= c("H", "L", "O", "F", "P", "C", "E", "I", "M", "A"))
semPaths(my.plot, whatLabels="est", nCharEdges=10, nCharNodes=10,
         layout="spring", color="yellow")
```



```
sessionInfo()

## R version 3.3.1 (2016-06-21)
## Platform: x86_64-w64-mingw32/x64 (64-bit)
## Running under: Windows 10 x64 (build 10586)
##
## locale:
## [1] LC_COLLATE=English_United States.1252
```

```

## [2] LC_CTYPE=English_United States.1252
## [3] LC_MONETARY=English_United States.1252
## [4] LC_NUMERIC=C
## [5] LC_TIME=English_United States.1252
##
## attached base packages:
## [1] parallel stats graphics grDevices utils datasets methods
## [8] base
##
## other attached packages:
## [1] semPlot_1.0.1 metaSEM_0.9.8 OpenMx_2.6.7 Rcpp_0.12.5 Matrix_1.2-6
## [6] MASS_7.3-45 digest_0.6.9
##
## loaded via a namespace (and not attached):
## [1] splines_3.3.1 ellipse_0.3-8 gtools_3.5.0
## [4] Formula_1.2-1 stats4_3.3.1 latticeExtra_0.6-28
## [7] yaml_2.1.13 d3Network_0.5.2.1 lisrelToR_0.1.4
## [10] pbivnorm_0.6.0 lattice_0.20-33 quantreg_5.26
## [13] quadprog_1.5-5 chron_2.3-47 RColorBrewer_1.1-2
## [16] ggm_2.3 minqa_1.2.4 colorspace_1.2-6
## [19] htmltools_0.3.5 plyr_1.8.4 psych_1.6.6
## [22] XML_3.98-1.4 SparseM_1.7 corpcor_1.6.8
## [25] scales_0.4.0 glasso_1.8 sna_2.3-2
## [28] whisker_0.3-2 jpeg_0.1-8 fdrtool_1.2.15
## [31] lme4_1.1-12 MatrixModels_0.4-1 huge_1.2.7
## [34] arm_1.8-6 rockchalk_1.8.101 mgcv_1.8-12
## [37] car_2.1-2 ggplot2_2.2.1.0 nnet_7.3-12
## [40] pbkrtest_0.4-6 mnormt_1.5-4 survival_2.39-5
## [43] magrittr_1.5 evaluate_0.9 nlme_3.1-128
## [46] foreign_0.8-66 tools_3.3.1 data.table_1.9.6
## [49] formatR_1.4 stringr_1.0.0 munsell_0.4.3
## [52] cluster_2.0.4 sem_3.1-7 grid_3.3.1
## [55] nloptr_1.0.4 rjson_0.2.15 igraph_1.0.1
## [58] lavaan_0.5-20 rmarkdown_0.9.6.14 boot_1.3-18
## [61] mi_1.0 gtable_0.2.0 abind_1.4-3
## [64] reshape2_1.4.1 qgraph_1.3.4 gridExtra_2.2.1
## [67] knitr_1.13 Hmisc_3.17-4 stringi_1.1.1
## [70] matrixcalc_1.0-3 rpart_4.1-10 acepack_1.3-3.3
## [73] png_0.1-7 coda_0.18-1

```