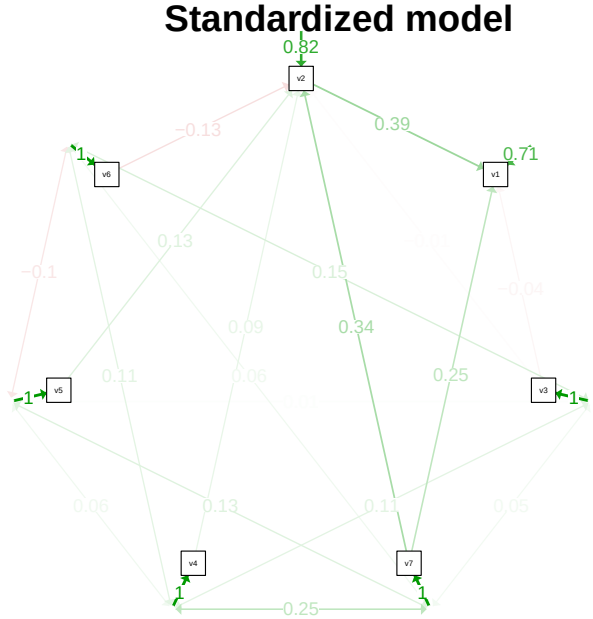
CONFIRMATORY FACTOR ANALYSIS

```
> library(sem)
> har.cor <- matrix(c(1.000, 0.4815, -.0306, 0.1458, 0.0479, -0.0302, 0.3952,
+                     0.4815, 1.000, 0.0014, 0.1683, 0.1939, -0.1165, 0.3700,
+                     -0.0306, 0.0014, 1.000, 0.1148, 0.0128, 0.1479, 0.0512,
+                     0.1458, 0.1683, 0.1148, 1.0000, 0.0599, 0.1061, 0.2486,
+                     0.0479, 0.1939, 0.0128, 0.0599, 1.0000, -0.0998, 0.1275,
+                     -0.0302, -0.1165, 0.1479, 0.1061, -0.0998, 1.00, 0.0606,
+                     0.3952, 0.3700, 0.0512, 0.2486, 0.1275, 0.0606, 1.000),nrow=7,ncol=7)
> sd <- c(2.0355, 1.4500, 0.4393, 2.1873, 2.7433, 4.0513, 1.0552)
> har.cov <- outer(sd, sd) * har.cor
> rownames(har.cov ) <-c("v1","v2","v3","v4","v5","v6", "v7")
> colnames(har.cov ) <-c("v1","v2","v3","v4","v5","v6", "v7")
> har.cov

          v1          v2          v3      v4        v5       v6       v7
v1  4.143260  1.42113521 -0.02736237 0.64914  0.267473 -0.24904 0.848834
v2  1.421135  2.10250000  0.00089178 0.53378  0.771293 -0.68437 0.566115
v3 -0.027362  0.00089178  0.19298449 0.11031  0.015426  0.26322 0.023734
v4  0.649138  0.53377776  0.11030913 4.78428  0.359425  0.94020 0.573778
v5  0.267473  0.77129251  0.01542569 0.35943  7.525695 -1.10917 0.369078
v6 -0.249042 -0.68436585  0.26322297 0.94020 -1.109170 16.41303 0.259061
v7  0.848834  0.56611480  0.02373373 0.57378  0.369078  0.25906 1.113447

> model<-specifyModel("C:/R/rmmva/model1 CFA.txt")
> model

   Path      Parameter
1  v2 -> v1  beta1
2  v3 -> v1  gama1
3  v7 -> v1  gama2
4  v3 -> v2  gama3
5  v4 -> v2  gama4
6  v5 -> v2  gama5
7  v6 -> v2  gama6
8  v7 -> v2  gama7
9  v1 <-> v1 e1
10 v2 <-> v2 e2

> sem <- sem(model,har.cov, 202,fixed.x=c("v3","v4","v5","v6", "v7"))
> summary(sem)

 Model Chisquare =  1.1998   Df =  3 Pr(>Chisq) = 0.75304
 AIC =  21.2
 BIC =  -14.725

 Normalized Residuals
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
-0.8330  0.0000  0.0000 -0.0176  0.0000  0.3160

 R-square for Endogenous Variables
    v2     v1
0.1818 0.2884
```

```
 Parameter Estimates
      Estimate  Std Error z value  Pr(>|z|)
beta1  0.544051 0.089925   6.05006 1.4479e-09 v1 <--- v2
gama1 -0.204572 0.276114  -0.74090 4.5875e-01 v1 <--- v3
gama2  0.490094 0.123732   3.96092 7.4661e-05 v1 <--- v7
gama3 -0.028211 0.214102  -0.13176 8.9517e-01 v2 <--- v3
gama4  0.060416 0.044086   1.37042 1.7056e-01 v2 <--- v4
gama5  0.069841 0.034237   2.03994 4.1357e-02 v2 <--- v5
gama6 -0.047337 0.023348  -2.02742 4.2620e-02 v2 <--- v6
gama7  0.465765 0.091257   5.10391 3.3271e-07 v2 <--- v7
e1     2.948483 0.294114  10.02497 1.1840e-23 v1 <--> v1
e2     1.720336 0.171605  10.02497 1.1840e-23 v2 <--> v2

 Iterations =  0

> modIndices(sem)

 5 largest modification indices, A matrix:
 v1<-v5  v5<-v1  v2<-v1  v1<-v4  v4<-v1
1.02817 0.84038 0.28779 0.15506 0.14634

  5 largest modification indices, P matrix:
  v5<->v1   v2<->v1   v4<->v1   v3<->v1   v7<->v1
1.0427665 0.2877894 0.1809028 0.0339229 0.0081493

> pathdiahar <- pathDiagram(sem)

digraph "sem" {
  rankdir=LR;
  size="8,8";
  node [fontname="Helvetica" fontsize=14 shape=box];
  edge [fontname="Helvetica" fontsize=10];
  center=1;
  "v2" -> "v1" [label="beta1"];
  "v3" -> "v1" [label="gama1"];
  "v7" -> "v1" [label="gama2"];
  "v3" -> "v2" [label="gama3"];
  "v4" -> "v2" [label="gama4"];
  "v5" -> "v2" [label="gama5"];
  "v6" -> "v2" [label="gama6"];
  "v7" -> "v2" [label="gama7"];
}

> library(qgraph)
> qgraph(sem)
```




```
> ################################################
> # CFA: ABILITY AND ASPIRATION
> # sca: self-concept of ability
> # ppe: perceived parental evaluation
> # pte: perceived teacher evaluation
> # ea: eduational aspiration
> # cp: college plans
> # the first four are assumed to measure ability and the last two the aspiration
> # measure the correlation between the two concepts
> ################################################
> library(sem)
> aspi.cov<- matrix(c(100,73,68,61,52,43,
+                       73,100,70,58,56,46,
+                     68,70,100,57,48,40,
+                      61,58,57,100,41,37,
+                      52,56,48,41,100,72,
+                     43,46,40,37,72,100),nrow=6,ncol=6)
> aspi.cov <- aspi.cov/100
> rownames(aspi.cov) <- c("ppe","sca","pte", "pfe","cp","ea")
> colnames(aspi.cov) <- c("ppe","sca","pte", "pfe","cp","ea")
> aspi.cov

     ppe  sca  pte  pfe   cp   ea
ppe 1.00 0.73 0.68 0.61 0.52 0.43
sca 0.73 1.00 0.70 0.58 0.56 0.46
pte 0.68 0.70 1.00 0.57 0.48 0.40
pfe 0.61 0.58 0.57 1.00 0.41 0.37
cp  0.52 0.56 0.48 0.41 1.00 0.72
ea  0.43 0.46 0.40 0.37 0.72 1.00
```

```
> model<-specifyModel("C:/R/rmmva/aspiration CFA.txt")
> model

   Path                       Parameter StartValue
1  ability -> sca             lambda1
2  ability -> ppe             lambda2
3  ability -> pte             lambda3
4  ability -> pfe             lambda4
5  aspiration -> ea           lambda5
6  aspiration -> cp           lambda6
7  ability <-> aspiration     rho
8  sca <-> sca                theta1
9  ppe <-> ppe                theta2
10 pte <-> pte                theta3
11 pfe <-> pfe                theta4
12 ea <-> ea                  theta5
13 cp <-> cp                  theta6
14 ability <-> ability        <fixed>   1
15 aspiration <-> aspiration <fixed>   1

> model.sem <- sem(model, aspi.cov, N=100)
> summary(model.sem)

 Model Chisquare =  1.651   Df =  8 Pr(>Chisq) = 0.98991
 AIC =  27.651
 BIC =  -35.19

 Normalized Residuals
     Min.   1st Qu.    Median      Mean   3rd Qu.      Max.
-0.186000 -0.079000 -0.000001 -0.005530  0.089000  0.225000

 R-square for Endogenous Variables
   sca    ppe    pte    pfe     ea     cp
0.7451 0.7213 0.6482 0.4834 0.6008 0.8629

 Parameter Estimates
        Estimate Std Error z value Pr(>|z|)
lambda1 0.86320  0.083213  10.3734 3.2771e-25 sca <--- ability
lambda2 0.84932  0.083936  10.1187 4.5642e-24 ppe <--- ability
lambda3 0.80509  0.086196   9.3402 9.6157e-21 pte <--- ability
lambda4 0.69527  0.091473   7.6007 2.9442e-14 pfe <--- ability
lambda5 0.77508  0.095553   8.1116 4.9975e-16 ea <--- aspiration
lambda6 0.92893  0.093311   9.9553 2.3921e-23 cp <--- aspiration
rho     0.66637  0.073290   9.0922 9.7080e-20 aspiration <--> ability
theta1  0.25488  0.055327   4.6068 4.0900e-06 sca <--> sca
theta2  0.27865  0.057127   4.8777 1.0731e-06 ppe <--> ppe
theta3  0.35184  0.063736   5.5202 3.3855e-08 pte <--> pte
theta4  0.51660  0.082220   6.2832 3.3164e-10 pfe <--> pfe
theta5  0.39924  0.090437   4.4146 1.0119e-05 ea <--> ea
theta6  0.13709  0.103006   1.3309 1.8323e-01 cp <--> cp

 Iterations =  29

> pathDiagram(model.sem)
```

```
digraph "model.sem" {
  rankdir=LR;
  size="8,8";
  node [fontname="Helvetica" fontsize=14 shape=box];
  edge [fontname="Helvetica" fontsize=10];
  center=1;
  "aspiration" [shape=ellipse]
  "ability" [shape=ellipse]
  "ability" -> "sca" [label="lambda1"];
  "ability" -> "ppe" [label="lambda2"];
  "ability" -> "pte" [label="lambda3"];
  "ability" -> "pfe" [label="lambda4"];
  "aspiration" -> "ea" [label="lambda5"];
  "aspiration" -> "cp" [label="lambda6"];
}
```

```
> library(qgraph)
> qgraph(model.sem)
```