IIVL Analyses Tour

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Import Data

```
cdi.dat <- read.csv("cdi.csv",header=T,na.strings = c("-99","99"))
attach(cdi.dat)
names(cdi.dat)
```

```
## [1] "country" "collact" "arab"    "id"      "eff"     "sdo"     "anger"
```

Descriptives

```
summary(cdi.dat)
```

```
##     country          collact          arab             id
##  Min.   : 1.000   Min.   : 0.000   Min.   : 0.000   Min.   : 0.000
##  1st Qu.: 3.000   1st Qu.: 1.000   1st Qu.: 4.000   1st Qu.: 2.000
##  Median : 7.000   Median : 2.000   Median : 7.000   Median : 5.000
##  Mean   : 6.607   Mean   : 3.522   Mean   : 6.171   Mean   : 4.749
##  3rd Qu.:10.000   3rd Qu.: 6.000   3rd Qu.: 9.000   3rd Qu.: 7.000
##  Max.   :12.000   Max.   :10.000   Max.   :10.000   Max.   :10.000
##                   NA's   :167      NA's   :65       NA's   :75
##       eff             sdo             anger
##  Min.   : 0.000   Min.   :1.000   Min.   : 0.000
##  1st Qu.: 3.000   1st Qu.:1.750   1st Qu.: 1.500
##  Median : 5.000   Median :3.000   Median : 4.000
##  Mean   : 5.333   Mean   :3.166   Mean   : 3.902
##  3rd Qu.: 7.000   3rd Qu.:4.500   3rd Qu.: 6.000
##  Max.   :19.000   Max.   :9.750   Max.   :10.000
##  NA's   :6        NA's   :17      NA's   :230
```

```
sapply(cdi.dat, mean, na.rm=TRUE)
```

```
##  country  collact     arab       id      eff      sdo    anger
## 6.607432 3.522468 6.171025 4.748754 5.333107 3.165641 3.902000
```

```
sapply(cdi.dat, sd, na.rm=TRUE)
```

```
##  country  collact     arab       id      eff      sdo    anger
## 3.501851 3.053585 3.084227 3.178040 2.719451 1.667729 2.820809
```

```
cor(cdi.dat,use="complete.obs")
```

```
##              country      collact         arab           id          eff
## country  1.00000000 -0.01179741 -0.08342191 -0.01700412 -0.031781936
## collact -0.01179741  1.00000000  0.39787729  0.62820863  0.161226858
## arab    -0.08342191  0.39787729  1.00000000  0.45077795  0.101235956
## id      -0.01700412  0.62820863  0.45077795  1.00000000  0.184611448
```

```
## eff     -0.03178194  0.16122686  0.10123596  0.18461145  1.000000000
## sdo      0.01527249 -0.15384594 -0.19150921 -0.25454925 -0.077079998
## anger    0.06099956  0.34585402  0.22414986  0.35094051  0.008137974
##                 sdo        anger
## country  0.01527249  0.060999563
## collact -0.15384594  0.345854020
## arab    -0.19150921  0.224149858
## id      -0.25454925  0.350940509
## eff     -0.07708000  0.008137974
## sdo      1.00000000 -0.113507365
## anger   -0.11350736  1.000000000
```

ANOVA

```
cdi.aov <- aov(arab~as.factor(country))
summary(cdi.aov)
```

```
##                     Df Sum Sq Mean Sq F value   Pr(>F)
## as.factor(country)   11    750   68.22   7.537 1.03e-12 ***
## Residuals          1403  12700    9.05
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## 65 observations deleted due to missingness
```

```
TukeyHSD(cdi.aov)
```

```
##   Tukey multiple comparisons of means
##     95% family-wise confidence level
##
## Fit: aov(formula = arab ~ as.factor(country))
##
## $`as.factor(country)`
##              diff         lwr          upr      p adj
## 2-1   -0.48545084 -1.7896564   0.81875473 0.9875442
## 3-1   -0.54611777 -1.8104936   0.71825802 0.9609150
## 4-1   -1.23291673 -2.8300101   0.36417659 0.3236948
## 5-1    0.37002853 -1.2438531   1.98391020 0.9998475
## 6-1   -0.37550668 -1.6449537   0.89394032 0.9982873
## 7-1   -1.04182841 -2.2198729   0.13621609 0.1436457
## 8-1   -2.41515082 -3.8602887  -0.97001295 0.0000035
## 9-1    0.64686469 -1.0798088   2.37353817 0.9868765
## 10-1  -0.55826352 -1.9817968   0.86526975 0.9811221
## 11-1  -1.74177507 -2.9230685  -0.56048168 0.0000977
## 12-1  -1.06577899 -2.5064241   0.37486609 0.3918061
## 3-2   -0.06066693 -1.2348455   1.11351168 1.0000000
## 4-2   -0.74746590 -2.2741474   0.77921559 0.9082537
## 5-2    0.85547936 -0.6887562   2.39971488 0.8106716
## 6-2    0.10994416 -1.0696935   1.28958180 1.0000000
## 7-2   -0.55637758 -1.6370432   0.52428802 0.8749437
## 8-2   -1.92969998 -3.2966209  -0.56277908 0.0002602
## 9-2    1.13231552 -0.5294458   2.79407682 0.5274495
## 10-2  -0.07281268 -1.4168723   1.27124694 1.0000000
## 11-2  -1.25632424 -2.3405306  -0.17211790 0.0085117
```
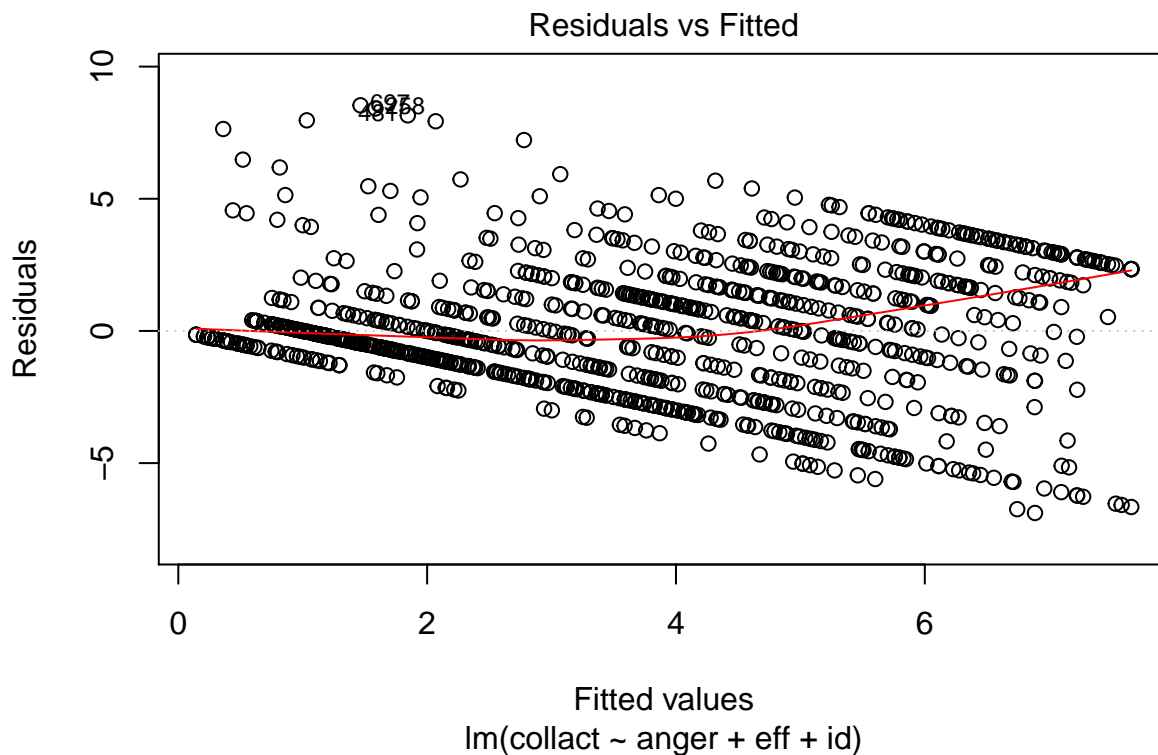
```
## 12-2   -0.58032816 -1.9424983  0.78184201 0.9646365
## 4-3    -0.68679896 -2.1795985  0.80600053 0.9390920
## 5-3     0.91614630 -0.5946010  2.42689357 0.7036730
## 6-3     0.17061109 -0.9648355  1.30605768 0.9999980
## 7-3    -0.49571064 -1.5279568  0.53653551 0.9189776
## 8-3    -1.86903305 -3.1980051 -0.54006099 0.0002823
## 9-3     1.19298246 -0.4377059  2.82367083 0.4101076
## 10-3   -0.01214575 -1.3175921  1.29330063 1.0000000
## 11-3   -1.19565730 -2.2316097 -0.15970491 0.0090018
## 12-3   -0.51966122 -1.8437464  0.80442395 0.9810087
## 5-4     1.60294526 -0.1955036  3.40139411 0.1356677
## 6-4     0.85741006 -0.6396871  2.35450721 0.7748736
## 7-4     0.19108832 -1.2293317  1.61150835 0.9999994
## 8-4    -1.18223408 -2.8309389  0.46647076 0.4432092
## 9-4     1.87978142 -0.0205358  3.78009864 0.0556710
## 10-4    0.67465322 -0.9551478  2.30445418 0.9714315
## 11-4   -0.50885834 -1.9319740  0.91425737 0.9910416
## 12-4    0.16713774 -1.4776305  1.81190596 1.0000000
## 6-5    -0.74553521 -2.2605292  0.76945881 0.9052416
## 7-5    -1.41185694 -2.8511276  0.02741372 0.0603524
## 8-5    -2.78517935 -4.4501522 -1.12020648 0.0000034
## 9-5     0.27683616 -1.6376122  2.19128451 0.9999986
## 10-5   -0.92829205 -2.5745478  0.71796375 0.7921305
## 11-5   -2.11180360 -3.5537347 -0.66987251 0.0001144
## 12-5   -1.43580752 -3.0968823  0.22526727 0.1686513
## 7-6    -0.66632173 -1.7047733  0.37212984 0.6225483
## 8-6    -2.03964414 -3.3734418 -0.70584645 0.0000402
## 9-6     1.02237136 -0.6122522  2.65699491 0.6604823
## 10-6   -0.18275684 -1.4931155  1.12760181 0.9999991
## 11-6   -1.36626840 -2.4084041 -0.32413265 0.0011423
## 12-6   -0.69027231 -2.0192009  0.63865624 0.8682147
## 8-7    -1.37332241 -2.6204429 -0.12620194 0.0168378
## 9-7     1.68869310  0.1239927  3.25339349 0.0215854
## 10-7    0.48356489 -0.7384551  1.70558493 0.9797514
## 11-7   -0.69994666 -1.6285693  0.22867602 0.3615173
## 12-7   -0.02395058 -1.2658621  1.21796095 1.0000000
## 9-8     3.06201550  1.2874953  4.83653570 0.0000013
## 10-8    1.85688730  0.3756825  3.33809207 0.0025180
## 11-8    0.67337574 -0.5768141  1.92356561 0.8376786
## 12-8    1.34937183 -0.1482860  2.84702962 0.1250665
## 10-9   -1.20512821 -2.9620987  0.55184232 0.5166355
## 11-9   -2.38863976 -3.9557877 -0.82149186 0.0000436
## 12-9   -1.71264368 -3.4835069  0.05821959 0.0689500
## 11-10  -1.18351156 -2.4086639  0.04164076 0.0696833
## 12-10  -0.50751547 -1.9843372  0.96930624 0.9935816
## 12-11   0.67599608 -0.5689977  1.92098986 0.8302532
```
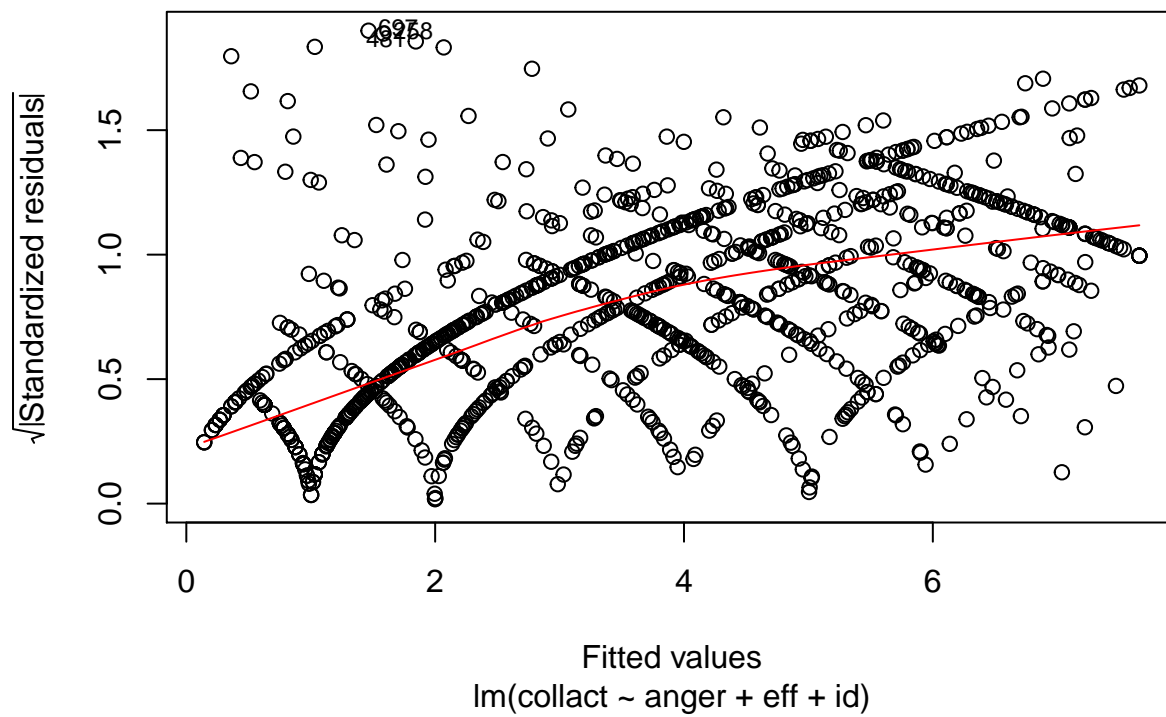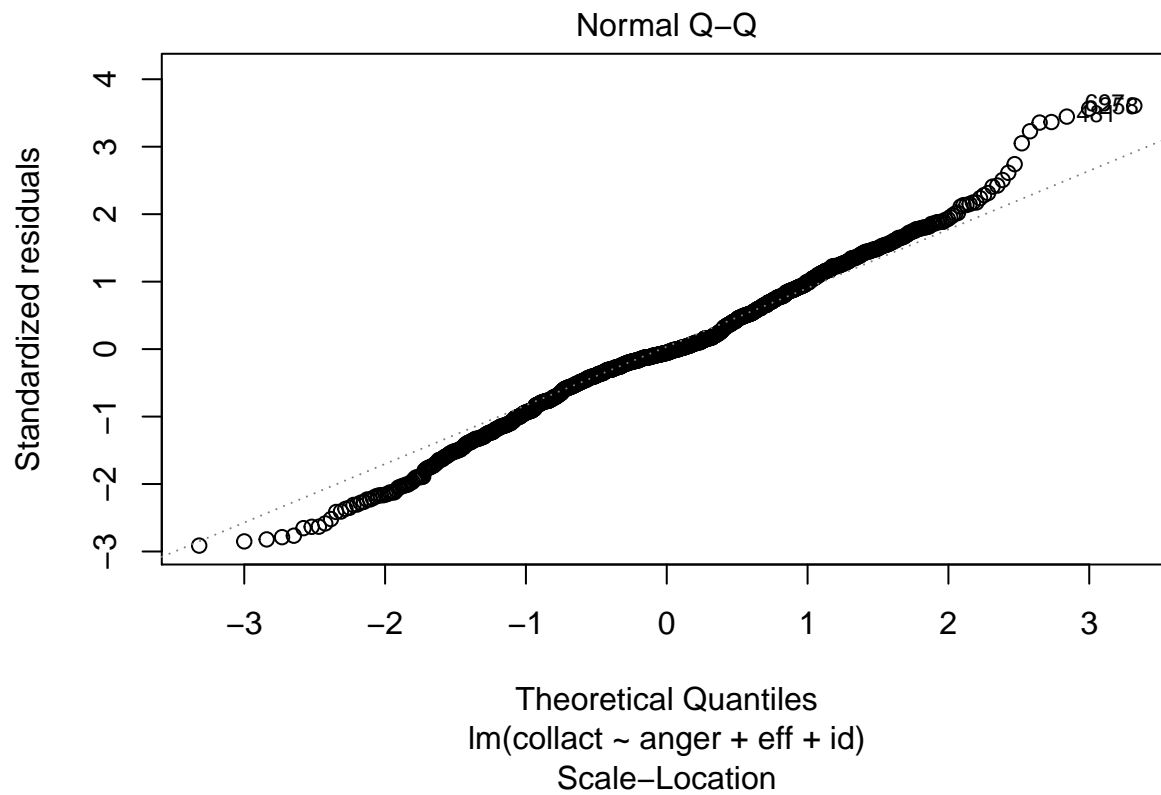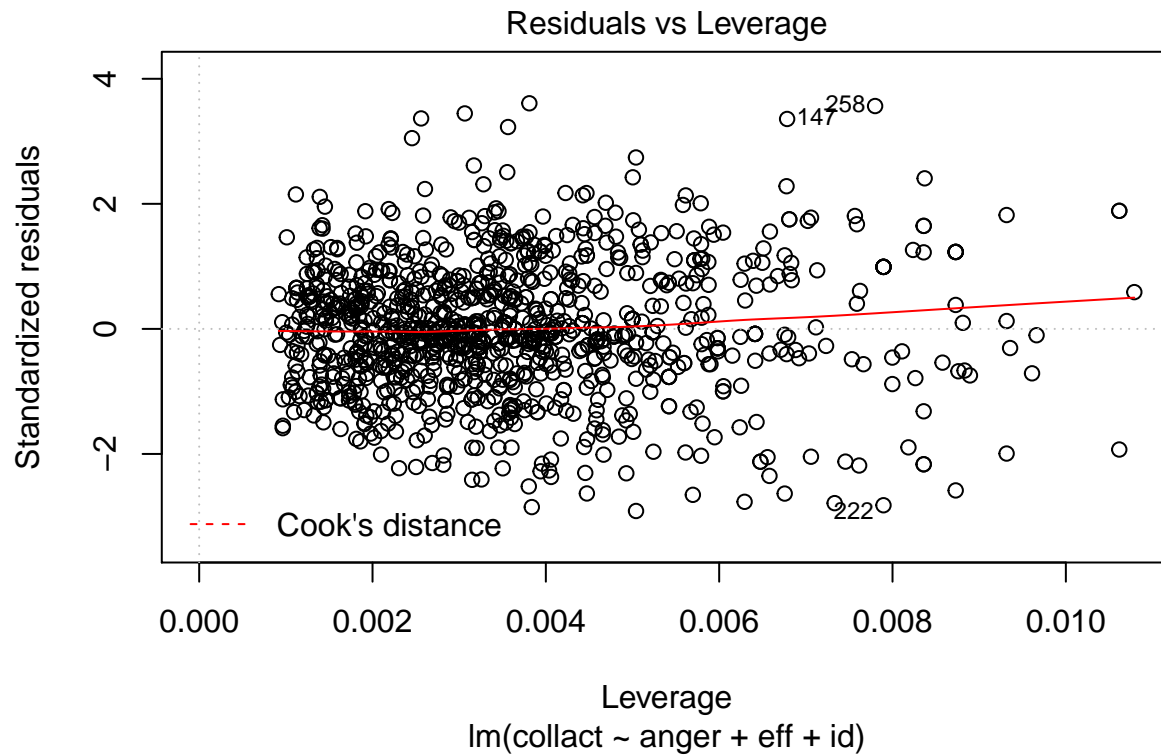
Regression

```
cdi.reg <- lm(collact~anger+eff+id)
summary(cdi.reg)
```

```
## 
## Call:
## lm(formula = collact ~ anger + eff + id)
## 
## Residuals:
##      Min      1Q  Median      3Q     Max
## -6.8856 -1.3022 -0.1279  1.4736  8.5356
## 
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.01847    0.19083   0.097   0.9229
## anger        0.15482    0.02634   5.878 5.48e-09 ***
## eff          0.06252    0.02678   2.334   0.0198 *
## id           0.54678    0.02413  22.657  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## 
## Residual standard error: 2.37 on 1107 degrees of freedom
##   (369 observations deleted due to missingness)
## Multiple R-squared:  0.4153, Adjusted R-squared:  0.4137
## F-statistic: 262.1 on 3 and 1107 DF,  p-value: < 2.2e-16
```

```r
plot(cdi.reg)
```

Normal Q-Q

Standardized residuals

Theoretical Quantiles
lm(collact ~ anger + eff + id)

Scale-Location

√|Standardized residuals|

Fitted values
lm(collact ~ anger + eff + id)

Residuals vs Leverage

lm(collact ~ anger + eff + id)

Structural Equation Modeling

```
library(lavaan)
```

```
## This is lavaan 0.5-20
```

```
## lavaan is BETA software! Please report any bugs.
```

```
library(semPlot)
```

```
path.model <- '
  # regressions
    collact ~ anger + eff + arab + sdo + id
    anger ~ sdo + id
    eff ~ sdo + id
    arab ~ sdo + id
'
path.fitted<-sem(path.model, data=cdi.dat, fixed.x=FALSE)
```

```
## Found more than one class "Model" in cache; using the first, from namespace 'lavaan'
```

```
summary(path.fitted, fit.measures=TRUE, standardized=TRUE)
```

```
## lavaan (0.5-20) converged normally after  22 iterations
##
##                                                 Used       Total
##   Number of observations                        1099        1480
##
##   Estimator                                        ML
```

```
##   Minimum Function Test Statistic                    11.374
##   Degrees of freedom                                      3
##   P-value (Chi-square)                               0.010
##
## Model test baseline model:
##
##   Minimum Function Test Statistic                  1071.344
##   Degrees of freedom                                     14
##   P-value                                            0.000
##
## User model versus baseline model:
##
##   Comparative Fit Index (CFI)                        0.992
##   Tucker-Lewis Index (TLI)                           0.963
##
## Loglikelihood and Information Criteria:
##
##   Loglikelihood user model (H0)               -15379.347
##   Loglikelihood unrestricted model (H1)       -15373.660
##
##   Number of free parameters                             18
##   Akaike (AIC)                                   30794.694
##   Bayesian (BIC)                                 30884.733
##   Sample-size adjusted Bayesian (BIC)            30827.560
##
## Root Mean Square Error of Approximation:
##
##   RMSEA                                              0.050
##   90 Percent Confidence Interval           0.022   0.083
##   P-value RMSEA <= 0.05                              0.431
##
## Standardized Root Mean Square Residual:
##
##   SRMR                                               0.019
##
## Parameter Estimates:
##
##   Information                                     Expected
##   Standard Errors                                 Standard
##
## Regressions:
##                   Estimate  Std.Err  Z-value  P(>|z|)   Std.lv  Std.all
##   collact ~
##     anger            0.146    0.026    5.630    0.000    0.146    0.137
##     eff              0.061    0.026    2.290    0.022    0.061    0.053
##     arab             0.135    0.026    5.214    0.000    0.135    0.134
##     sdo              0.042    0.044    0.959    0.338    0.042    0.023
##     id               0.497    0.027   18.674    0.000    0.497    0.516
##   anger ~
##     sdo             -0.045    0.051   -0.885    0.376   -0.045   -0.026
##     id               0.310    0.026   11.794    0.000    0.310    0.344
##   eff ~
##     sdo             -0.052    0.050   -1.050    0.294   -0.052   -0.032
##     id               0.149    0.026    5.758    0.000    0.149    0.176
```

```
##   arab ~
##      sdo              -0.151    0.051   -2.960    0.003   -0.151   -0.082
##      id                0.411    0.027   15.501    0.000    0.411    0.430
##
## Covariances:
##                     Estimate  Std.Err  Z-value  P(>|z|)   Std.lv   Std.all
##   sdo ~~
##      id              -1.367    0.167   -8.178    0.000   -1.367   -0.255
##
## Variances:
##                     Estimate  Std.Err  Z-value  P(>|z|)   Std.lv   Std.all
##      collact          5.470    0.233   23.441    0.000    5.470    0.571
##      anger            7.353    0.314   23.441    0.000    7.353    0.876
##      eff              7.112    0.303   23.441    0.000    7.112    0.965
##      arab             7.465    0.318   23.441    0.000    7.465    0.790
##      sdo              2.792    0.119   23.441    0.000    2.792    1.000
##      id              10.324    0.440   23.441    0.000   10.324    1.000
```

`semPaths(path.fitted)`