Example 8: Path Analysis for Mediation

(complete syntax and output available for SAS, Mplus, and STATA electronically)

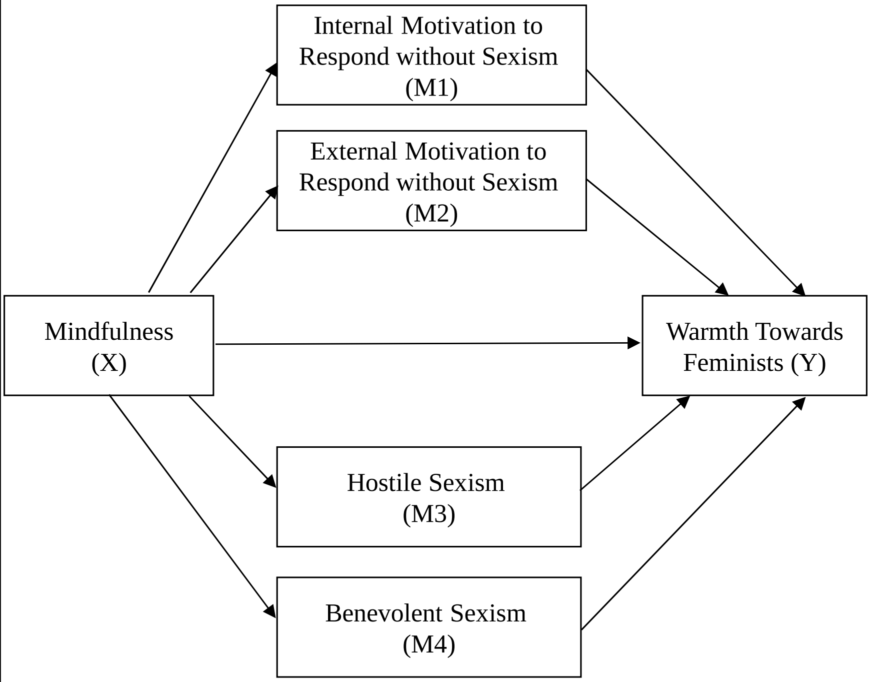

Figure 1 from: Gervais, S. J. & Hoffman, L. (2013). Just think about it: Mindfulness, sexism, and prejudice towards feminists. *Sex Roles*, *68*(5), 283-295.

A sample of 653 undergraduates completed the six measures depicted in Figure 1 (residual covariances among the mediators are not shown for diagram clarity). Table 3 shows the correlations of the six variables by gender.

The research questions were as follows: (1) To what extent do these four mediators account for the relationship between mindfulness and warmth towards feminists? (2) How do these direct and indirect effects differ by gender?

Accordingly, we will begin with a single-group model, and then examine a multiple-group model in which all parameters are estimated separately for men and women. From there, one would proceed by constraining specific direct and indirect effects to be equal across genders and note the decrease in model fit in doing so.

Table 3 Inter-correlations of all factors by participant gender for main study

	1.	2.	3.	4.	5.	6.
1. Mindfulness	–	**.20**	.10	**−.17**	−.08	**.15**
2. Internal motivation	.04	–	**.39**	.06	**−.40**	**.45**
3. External motivation	−.04	**.38**	–	**.14**	.05	.11
4. Benevolent sexism	.08	−.01	**.17**	–	.07	−.06
5. Hostile sexism	**−.11**	**−.21**	.03	**.20**	–	**−.44**
6. Warmth toward feminists	−.00	**.30**	**.14**	−.08	**−.24**	–

Bold font denotes significant correlation coefficients. Correlations for men (*N*=272–273) are reported above the diagonal and correlations for women (*N*=378–380) are reported below the diagonal. Mindfulness (1 = *rarely*, 4 = *almost always*), Warmth Toward Feminists (0° = *very coolly*, 100° = *very warmly*), and Internal Motivation, External Motivation, Hostile Sexism, Benevolent Sexism (1 = *disagree strongly*, 7 = *agree strongly*)

SAS PROC CALIS Single-Group Path Model:

```
TITLE1 "Single-Group Path Model";
PROC CALIS DATA=work.Mindfull MEANSTR METHOD=FIML;
* VAR = List of variables in model;
  VAR  MindC Intern Extern Hostile Benev Nontrad;
* MEAN = Labeling means/intercepts per variable;
  MEAN MindC=Xint, Intern=M1int, Extern=M2int, Hostile=M3int, Benev=M4int, NonTrad=Yint;
* PVAR = Labeling variances/residual variances per variable;
  PVAR MindC=Xvar, Intern=M1var, Extern=M2var, Hostile=M3var, Benev=M4var, NonTrad=Yvar;
* PCOV = Requesting and labeling residual covariances;
  PCOV Intern Extern=CovM12, Intern Hostile=CovM13, Intern Benev=CovM14,
       Extern Hostile=CovM23, Extern Benev=CovM24, Hostile Benev=Cov34;
```

```
* PATH = Model specification and labels;
  PATH MindC ---> NonTrad = mXtoY,
       MindC ---> Intern Extern Hostile Benev = XtoM1 XtoM2 XtoM3 XtoM4,
       Intern Extern Hostile Benev ---> NonTrad = M1toY M2toY M3toY M4toY;
* TESTFUNC = Requesting indirect effects;
  TESTFUNC XtoM1toY XtoM2toY XtoM3toY XtoM4toY;
           XtoM1toY = XtoM1*M1toY; XtoM2toY = XtoM2*M2toY;
           XtoM3toY = XtoM3*M3toY; XtoM4toY = XtoM4*M4toY;
RUN; TITLE1;
```

MPLUS Single-Group Path Model (see syntax for full code):

```
! Model code: ON = Y ON X, WITH = correlation
! Labels in parentheses (can be used to name constraints between groups)
MODEL:
! Bring X into the likelihood by estimating its mean and variance
  [Mind1C] (Xint); Mind1C (Xvar);
! Intercepts and residual variances for other variables
  [Intern Extern Hostile Benev NonTrad] (M1int M2int M3int M4int Yint);
   Intern Extern Hostile Benev NonTrad  (M1var M2var M3var M4var Yvar);
! Direct Mind1C --> NonTrad
  NonTrad  ON Mind1C (XtoY);
! Left side of model
  Intern   ON Mind1C (XtoM1);
  Extern   ON Mind1C (XtoM2);
  Hostile  ON Mind1C (XtoM3);
  Benev    ON Mind1C (XtoM4);
! Right side of model
  NonTrad ON Intern  (M1toY);
  NonTrad ON Extern  (M2toY);
  NonTrad ON Hostile (M3toY);
  NonTrad ON Benev   (M4toY);
! Residual covariances among mediator variables
  Intern Extern Hostile Benev WITH Intern Extern Hostile Benev;
! Testing indirect effects
  MODEL CONSTRAINT:
  NEW (XtoM1toY XtoM2toY XtoM3toY XtoM4toY);
  XtoM1toY = XtoM1*M1toY; XtoM2toY = XtoM2*M2toY;
  XtoM3toY = XtoM3*M3toY; XtoM4toY = XtoM4*M4toY;
```

STATA SEM Single-Group Path Model:

```
* /// means continue the command + comment
*  // means comment only
* sem, standardized // print standardized effects this time
* first ran using coeflegend, which displays parameter labels (see log)

display as result "Single group path model omitting coeflegend"
display as result "Adding indirect effects (that use parm labels)"
sem (mindc -> nontrad)                              /// XtoY
    (mindc -> intern extern hostile benev )         /// XtoM1,M2,M3,M4
    (intern extern hostile benev -> nontrad),       /// M1,M2,M3,M4toY
     means(mindc)                                   /// print mean
       var(mindc)                                   /// print variance
     covariance(e.intern*e.extern e.intern*e.hostile) /// residual covariances
     covariance(e.intern*e.benev  e.extern*e.hostile) /// residual covariances
     covariance(e.extern*e.benev  e.hostile*e.benev)  /// residual covariances
     method(mlmv)                                    // full-information ML
     estat eqgof,                                    // R2 per variable
     estat gof, stats(all),                          // model fit
     nlcom _b[intern:mindc]*_b[nontrad:intern]   // indirect effect XtoM1toY
     nlcom _b[extern:mindc]*_b[nontrad:extern]   // indirect effect XtoM2toY
     nlcom _b[hostile:mindc]*_b[nontrad:hostile] // indirect effect XtoM3toY
     nlcom _b[benev:mindc]*_b[nontrad:benev]     // indirect effect XtoM4toY
```

STATA SEM unstandardized output for the Single-Group Path Model:

```
Structural equation model                       Number of obs      =       653
Estimation method  = mlmv
Log likelihood     = -5410.7727
------------------------------------------------------------------------------------
                       |                 OIM
                       |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-----------------------+------------------------------------------------------------
Structural             |
  nontrad <-           |
                intern |   .5626147   .0731554     7.69   0.000     .4192328    .7059967
                extern |   .0578879   .0760251     0.76   0.446    -.0911186    .2068944
               hostile |  -.8125585    .107334    -7.57   0.000    -1.022929   -.6021878
                 benev |  -.2124246    .107228    -1.98   0.048    -.4225876   -.0022615
                 mindc |  -.0119824   .1889878    -0.06   0.949    -.3823917    .3584269
                 _cons |   7.456182   .7308971    10.20   0.000      6.02365    8.888714
  ---------------------+------------------------------------------------------------
  intern <-            |
                 mindc |   .3353112   .1164601     2.88   0.004     .1070536    .5635687
                 _cons |   4.971255   .1099664    45.21   0.000     4.755725    5.186785
  ---------------------+------------------------------------------------------------
  extern <-            |
                 mindc |    .041326   .1079943     0.38   0.702     -.170339     .252991
                 _cons |    4.06338   .1017661    39.93   0.000     3.863922    4.262838
  ---------------------+------------------------------------------------------------
  hostile <-           |
                 mindc |  -.1958762   .0742917    -2.64   0.008    -.3414852   -.0502672
                 _cons |   4.069324   .0701493    58.01   0.000     3.931834    4.206814
  ---------------------+------------------------------------------------------------
  benev <-             |
                 mindc |  -.0521908   .0699051    -0.75   0.455    -.1892022    .0848206
                 _cons |   4.108647   .0660072    62.25   0.000     3.979276    4.238019
-----------------------+------------------------------------------------------------
           mean(mindc)|   .8345001   .0172896    48.27   0.000     .8006132    .8683871
-----------------------+------------------------------------------------------------
        var(e.nontrad)|   4.400699   .2446747                      3.946351    4.907358
         var(e.intern)|   1.728817    .095677                      1.551106    1.926889
         var(e.extern)|   1.477754   .0821223                      1.325253    1.647804
        var(e.hostile)|   .7035186   .0389344                      .6312015    .7841211
          var(e.benev)|   .6228914   .0344723                      .5588622    .6942564
            var(mindc)|    .195201   .0108029                      .1751356    .2175653
-----------------------+------------------------------------------------------------
 cov(e.intern,e.extern)|   .6021503   .0673758     8.94   0.000     .4700961    .7342044
cov(e.intern,e.hostile)|  -.3739513    .045571    -8.21   0.000    -.4632688   -.2846338
  cov(e.intern,e.benev)|  -.0067172     .04061    -0.17   0.869    -.0863114     .072877
cov(e.extern,e.hostile)|   .0364342   .0401216     0.91   0.364    -.0422026    .1150711
  cov(e.extern,e.benev)|    .146955   .0380589     3.86   0.000     .0723609     .221549
 cov(e.hostile,e.benev)|   .1118392   .0262723     4.26   0.000     .0603464     .163332
------------------------------------------------------------------------------------
LR test of model vs. saturated: chi2(0)   =      0.00, Prob > chi2 =      .

Equation-level goodness of fit
------------------------------------------------------------------------------
             |              Variance               |
     depvars |    fitted  predicted   residual | R-squared        mc      mc2
-------------+---------------------------------+------------------------------
observed     |                                 |
     nontrad |  5.883612   1.482912   4.400699 |  .2520411   .502037  .2520411
      intern |  1.750765   .0219471   1.728817 |  .0125357  .1119632  .0125357
      extern |  1.478088   .0003334   1.477754 |  .0002255  .0150181  .0002255
     hostile |   .711008   .0074894   .7035186 |  .0105335  .1026326  .0105335
       benev |  .6234231   .0005317   .6228914 |  .0008529  .0292041  .0008529
-------------+---------------------------------+------------------------------
     overall |                                 |  .0176456
------------------------------------------------------------------------------
mc  = correlation between depvar and its prediction
mc2 = mc^2 is the Bentler-Raykov squared multiple correlation coefficient
```

```
----------------------------------------------------------------------------
Fit statistic        |      Value   Description
---------------------+------------------------------------------------------
Likelihood ratio     |
          chi2_ms(0) |      0.000   model vs. saturated
            p > chi2 |          .
         chi2_bs(15) |    439.601   baseline vs. saturated
            p > chi2 |      0.000
---------------------+------------------------------------------------------
Population error     |
               RMSEA |      0.000   Root mean squared error of approximation
 90% CI, lower bound |      0.000
         upper bound |      0.000
              pclose |      1.000   Probability RMSEA <= 0.05
---------------------+------------------------------------------------------
Information criteria |
                 AIC |  10871.545   Akaike's information criterion
                 BIC |  10983.585   Bayesian information criterion
---------------------+------------------------------------------------------
Baseline comparison  |
                 CFI |      1.000   Comparative fit index
                 TLI |      1.000   Tucker-Lewis index
---------------------+------------------------------------------------------
Size of residuals    |
                  CD |      0.018   Coefficient of determination
----------------------------------------------------------------------------
Note: SRMR is not reported because of missing values.

.          nlcom _b[intern:mindc]*_b[nontrad:intern]   // indirect effect XtoM1toY
       _nl_1:  _b[intern:mindc]*_b[nontrad:intern]
------------------------------------------------------------------------------
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |    .188651   .0699633     2.70   0.007     .0515254    .3257765
------------------------------------------------------------------------------

.          nlcom _b[extern:mindc]*_b[nontrad:extern]   // indirect effect XtoM2toY
       _nl_1:  _b[extern:mindc]*_b[nontrad:extern]
------------------------------------------------------------------------------
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .0023923   .0070151     0.34   0.733    -.0113572    .0161417
------------------------------------------------------------------------------

.          nlcom _b[hostile:mindc]*_b[nontrad:hostile] // indirect effect XtoM3toY
       _nl_1:  _b[hostile:mindc]*_b[nontrad:hostile]
------------------------------------------------------------------------------
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .1591609   .0639227     2.49   0.013     .0338747    .2844471
------------------------------------------------------------------------------

.          nlcom _b[benev:mindc]*_b[nontrad:benev]     // indirect effect XtoM4toY
       _nl_1:  _b[benev:mindc]*_b[nontrad:benev]
------------------------------------------------------------------------------
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .0110866   .0158691     0.70   0.485    -.0200162    .0421894
------------------------------------------------------------------------------
```

SAS PROC CALIS Multiple-Group Path Model (all parameters separate by gender):

```
TITLE1 "Multiple-Group Path Model";
PROC CALIS DATA=work.Mindfull MEANSTR METHOD=FIML;
* VAR = List of variables in model;
  VAR  MindC Intern Extern Hostile Benev Nontrad;
* GROUP creates separate models (referred to by number);
  GROUP 1 / LABEL="Men"   DATA=work.Men;
  GROUP 2 / LABEL="Women" DATA=work.Women;
* Model for Men -- all parameters are now labeled separately for full non-invariance;
  MODEL 1 / GROUP=1;
  MEAN MindC=mXint, Intern=mM1int, Extern=mM2int, Hostile=mM3int, Benev=mM4int, NonTrad=mYint;
  PVAR MindC=mXvar, Intern=mM1var, Extern=mM2var, Hostile=mM3var, Benev=mM4var, NonTrad=mYvar;
  PCOV Intern Extern=mCovM12, Intern Hostile=mCovM13, Intern Benev=mCovM14,
       Extern Hostile=mCovM23, Extern Benev=mCovM24, Hostile Benev=mCov34;
  PATH MindC ---> NonTrad = mXtoY,
       MindC ---> Intern Extern Hostile Benev = mXtoM1 mXtoM2 mXtoM3 mXtoM4,
       Intern Extern Hostile Benev ---> NonTrad = mM1toY mM2toY mM3toY mM4toY;
* Model for Women -- all parameters are now labeled separately for full non-invariance;;
  MODEL 2 / GROUP=2;
  MEAN MindC=wXint, Intern=wM1int, Extern=wM2int, Hostile=wM3int, Benev=wM4int, NonTrad=wYint;
  PVAR MindC=wXvar, Intern=wM1var, Extern=wM2var, Hostile=wM3var, Benev=wM4var, NonTrad=wYvar;
  PCOV Intern Extern=wCovM12, Intern Hostile=wCovM13, Intern Benev=wCovM14,
       Extern Hostile=wCovM23, Extern Benev=wCovM24, Hostile Benev=wCov34;
  PATH MindC ---> NonTrad = wXtoY,
       MindC ---> Intern Extern Hostile Benev = wXtoM1 wXtoM2 wXtoM3 wXtoM4,
       Intern Extern Hostile Benev ---> NonTrad = wM1toY wM2toY wM3toY wM4toY;
* Indirect effects for both groups;
  TESTFUNC mXtoM1toY wXtoM1toY mXtoM2toY wXtoM2toY mXtoM3toY wXtoM3toY mXtoM4toY wXtoM4toY;
           mXtoM1toY = mXtoM1*mM1toY; wXtoM1toY = wXtoM1*wM1toY;
           mXtoM2toY = mXtoM2*mM2toY; wXtoM2toY = wXtoM2*wM2toY;
           mXtoM3toY = mXtoM2*mM2toY; wXtoM3toY = wXtoM3*wM3toY;
           mXtoM4toY = mXtoM2*mM2toY; wXtoM4toY = wXtoM4*wM4toY;
RUN; TITLE1;
```

MPLUS Multiple-Group Path Model (all parameters separate by gender; see syntax for full code):

```
! Model code: ON = Y ON X, WITH = correlation
! Labels in parentheses (can be used to name constraints between groups)
MODEL:
! Bring X into the likelihood by estimating its mean and variance
  [Mind1C] (mXint); Mind1C (mXvar);
! Intercepts and residual variances for other variables
  [Intern Extern Hostile Benev NonTrad] (mM1int mM2int mM3int mM4int mYint);
   Intern Extern Hostile Benev NonTrad  (mM1var mM2var mM3var mM4var mYvar);
! Direct Mind1C --> NonTrad
  NonTrad  ON Mind1C (mXtoY);
! Left side of model
  Intern   ON Mind1C (mXtoM1);
  Extern   ON Mind1C (mXtoM2);
  Hostile  ON Mind1C (mXtoM3);
  Benev    ON Mind1C (mXtoM4);
! Right side of model
  NonTrad ON Intern  (mM1toY);
  NonTrad ON Extern  (mM2toY);
  NonTrad ON Hostile (mM3toY);
  NonTrad ON Benev   (mM4toY);
! Residual covariances among mediator variables
  Intern Extern Hostile Benev WITH Intern Extern Hostile Benev;
! Testing indirect effects
  MODEL CONSTRAINT:
  NEW (mXtoM1Y mXtoM2Y mXtoM3Y mXtoM4Y);
  mXtoM1Y = mXtoM1*mM1toY; mXtoM2Y = mXtoM2*mM2toY;
  mXtoM3Y = mXtoM3*mM3toY; mXtoM4Y = mXtoM4*mM4toY;
```

```
MODEL Women:
! Bring X into the likelihood by estimating its mean and variance
  [Mind1C] (wXint); Mind1C (wXvar);
! Intercepts and residual variances for other variables
  [Intern Extern Hostile Benev NonTrad] (wM1int wM2int wM3int wM4int wYint);
   Intern Extern Hostile Benev NonTrad  (wM1var wM2var wM3var wM4var wYvar);
! Direct Mind1C --> NonTrad
  NonTrad  ON Mind1C (wXtoY);
! Left side of model
  Intern   ON Mind1C (wXtoM1);
  Extern   ON Mind1C (wXtoM2);
  Hostile  ON Mind1C (wXtoM3);
  Benev    ON Mind1C (wXtoM4);
! Right side of model
  NonTrad ON Intern  (wM1toY);
  NonTrad ON Extern  (wM2toY);
  NonTrad ON Hostile (wM3toY);
  NonTrad ON Benev   (wM4toY);
! Residual covariances among mediator variables
  Intern Extern Hostile Benev WITH Intern Extern Hostile Benev;
! Testing indirect effects
  MODEL CONSTRAINT:
  NEW (wXtoM1Y wXtoM2Y wXtoM3Y wXtoM4Y);
  wXtoM1Y = wXtoM1*wM1toY; wXtoM2Y = wXtoM2*wM2toY;
  wXtoM3Y = wXtoM3*wM3toY; wXtoM4Y = wXtoM4*wM4toY;
```

STATA SEM Multiple-Group Path Model (all parameters separate by gender):

```
* first ran using coeflegend, which displays parameter labels (see log)

display as result "Multiple group path model omitting coeflegend"
display as result "Adding indirect effects (that use parm labels)"
sem (mindc -> nontrad)                               /// XtoY
    (mindc -> intern extern hostile benev )          /// XtoM1,M2,M3,M4
    (intern extern hostile benev -> nontrad),        /// M1,M2,M3,M4toY
     means(mindc)                                    /// print mean
       var(mindc)                                    /// print variance
     covariance(e.intern*e.extern e.intern*e.hostile) /// residual covariances
     covariance(e.intern*e.benev  e.extern*e.hostile) /// residual covariances
     covariance(e.extern*e.benev  e.hostile*e.benev)  /// residual covariances
     method(mlmv)                                    /// full-information ML
     group(sexmw) ginvariant(none),                   // none= full non-invariance
     estat eqgof,                                     // R2 per variable
     estat gof, stats(all),                           // model fit
     estat ginvariant,      // Wald or Score test for each parm's invariance
                            // Wald  = test of constraining equal if unequal
                            // Score = test of allowing unequal if equal
     // men and women indirect effect XtoM1toY
     nlcom _b[intern:0bn.sexmw#c.mindc]*_b[nontrad:0bn.sexmw#c.intern]
     nlcom _b[intern:1.sexmw#c.mindc]*_b[nontrad:1.sexmw#c.intern]
     // men and women indirect effect XtoM2toY
     nlcom _b[extern:0bn.sexmw#c.mindc]*_b[nontrad:0bn.sexmw#c.extern]
     nlcom _b[extern:1.sexmw#c.mindc]*_b[nontrad:1.sexmw#c.extern]
     // men and women indirect effect XtoM3toY
     nlcom _b[hostile:0bn.sexmw#c.mindc]*_b[nontrad:0bn.sexmw#c.hostile]
     nlcom _b[hostile:1.sexmw#c.mindc]*_b[nontrad:1.sexmw#c.hostile]
     // men and women indirect effect XtoM4toY
     nlcom _b[benev:0bn.sexmw#c.mindc]*_b[nontrad:0bn.sexmw#c.benev]
     nlcom _b[benev:1.sexmw#c.mindc]*_b[nontrad:1.sexmw#c.benev]
```

STATA SEM unstandardized output for a Multiple-Group Path Model:

```
Structural equation model                       Number of obs      =        653
Grouping variable  = sexmw                      Number of groups   =          2
Estimation method  = mlmv
Log likelihood     = -5332.2072
------------------------------------------------------------------------------------
                       |                 OIM
                       |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-----------------------+------------------------------------------------------------
Structural             |
  nontrad <-           |
                intern |
                     0 |   .5480012   .1097146     4.99   0.000     .3329645     .763038
                     1 |   .4488746   .0970253     4.63   0.000     .2587086    .6390407
                extern |
                     0 |   .0473828   .1130167     0.42   0.675    -.1741259    .2688915
                     1 |   .0836082   .0987572     0.85   0.397    -.1099524    .2771687
               hostile |
                     0 |  -.8451654   .1564635    -5.40   0.000    -1.151828   -.5385025
                     1 |  -.5347936   .1499501    -3.57   0.000    -.8286905   -.2408967
                 benev |
                     0 |  -.1578276   .1593142    -0.99   0.322    -.4700778    .1544226
                     1 |  -.1591458   .1440195    -1.11   0.269    -.4414189    .1231274
                 mindc |
                     0 |   .2131587   .3014609     0.71   0.480    -.3776937    .8040111
                     1 |  -.1263696    .239163    -0.53   0.597    -.5951205    .3423813
                 _cons |
                     0 |   6.814568   1.124616     6.06   0.000     4.610361    9.018774
                     1 |   7.172311   .9379938     7.65   0.000     5.333877    9.010746
  ---------------------+------------------------------------------------------------
  intern <-            |
                 mindc |
                     0 |    .633305   .1905479     3.32   0.001     .2598381    1.006772
                     1 |   .0986061   .1390832     0.71   0.478     -.173992    .3712041
                 _cons |
                     0 |    4.39111   .1761513    24.93   0.000      4.04586     4.73636
                     1 |     5.4137   .1332709    40.62   0.000     5.152494    5.674906
  ---------------------+------------------------------------------------------------
  extern <-            |
                 mindc |
                     0 |   .2727332   .1725529     1.58   0.114    -.0654644    .6109308
                     1 |  -.1166402   .1378333    -0.85   0.397    -.3867886    .1535081
                 _cons |
                     0 |   3.870788   .1594745    24.27   0.000     3.558224    4.183352
                     1 |   4.199539   .1316457    31.90   0.000     3.941519     4.45756
  ---------------------+------------------------------------------------------------
  hostile <-           |
                 mindc |
                     0 |  -.1714754   .1238283    -1.38   0.166    -.4141744    .0712236
                     1 |  -.1813362   .0846223    -2.14   0.032    -.3471929   -.0154795
                 _cons |
                     0 |   4.333876   .1144726    37.86   0.000     4.109514    4.558238
                     1 |   3.852628   .0810859    47.51   0.000     3.693702    4.011553
  ---------------------+------------------------------------------------------------
  benev <-             |
                 mindc |
                     0 |  -.3137449   .1103874    -2.84   0.004    -.5301002   -.0973897
                     1 |   .1383824   .0874718     1.58   0.114    -.0330592    .3098239
                 _cons |
                     0 |   4.459746   .1020472    43.70   0.000     4.259737    4.659755
                     1 |   3.848452   .0838163    45.92   0.000     3.684175    4.012729
-----------------------+------------------------------------------------------------
           mean(mindc)|
                     0 |   .8168498   .0261972    31.18   0.000     .7655043    .8681953
                     1 |   .8471805   .0229674    36.89   0.000     .8021651    .8921958
-----------------------+------------------------------------------------------------
```

```
      var(e.nontrad)|
                 0  |   4.124248    .356281                      3.481866    4.885144
                 1  |   4.230226   .3073067                       3.66883    4.877525
       var(e.intern)|
                 0  |   1.857129   .1589556                      1.570312    2.196333
                 1  |   1.473471   .1068968                      1.278171    1.698612
       var(e.extern)|
                 0  |   1.522092   .1308062                      1.286145    1.801324
                 1  |   1.433397   .1043813                      1.242743    1.653301
      var(e.hostile)|
                 0  |   .7842846   .0671286                      .6631588    .9275339
                 1  |   .5454591   .0395718                      .4731617    .6288033
        var(e.benev)|
                 0  |   .6232648   .0533465                      .5270071    .7371039
                 1  |   .5828119   .0422816                      .5055636    .6718636
          var(mindc)|
                 0  |   .1873576   .0160363                      .1584219    .2215784
                 1  |   .2004512   .0145423                      .1738826    .2310795
--------------------+----------------------------------------------------------------
 cov(e.intern,e.extern)|
                 0  |   .6395836   .1101316     5.81   0.000     .4237297    .8554375
                 1  |   .5559517   .0801768     6.93   0.000      .398808    .7130954
cov(e.intern,e.hostile)|
                 0  |  -.4745932   .0784874    -6.05   0.000    -.6284257   -.3207606
                 1  |  -.1836749   .0469449    -3.91   0.000    -.2756853   -.0916645
  cov(e.intern,e.benev)|
                 0  |   .1068751   .0654347     1.63   0.102    -.0213747    .2351248
                 1  |  -.0116527    .047542    -0.25   0.806    -.1048333     .081528
cov(e.extern,e.hostile)|
                 0  |   .0579838   .0667428     0.87   0.385    -.0728297    .1887972
                 1  |   .0230488   .0454018     0.51   0.612    -.0659371    .1120347
  cov(e.extern,e.benev)|
                 0  |   .1540697   .0598145     2.58   0.010     .0368354     .271304
                 1  |   .1566726   .0476864     3.29   0.001      .063209    .2501362
 cov(e.hostile,e.benev)|
                 0  |    .035857   .0423704     0.85   0.397    -.0471874    .1189014
                 1  |   .1184571   .0295551     4.01   0.000     .0605301    .1763841
-------------------------------------------------------------------------------------
LR test of model vs. saturated: chi2(0)   =      0.00, Prob > chi2 =      .

Group #1 (sexmw=0; N=273)
Equation-level goodness of fit
------------------------------------------------------------------------------
             |                Variance               |
     depvars |    fitted  predicted   residual | R-squared        mc      mc2
-------------+---------------------------------+------------------------------
observed     |                                 |
     nontrad |  5.828462   1.704215   4.124248 |  .2923952  .5407358  .2923952
      intern |  1.932273   .0751445   1.857129 |  .0388892  .1972033  .0388892
      extern |  1.536028   .0139363   1.522092 |  .0090729   .095252  .0090729
     hostile |  .7897936    .005509   .7842846 |  .0069753  .0835181  .0069753
       benev |  .6417075   .0184427   .6232648 |  .0287401  .1695289  .0287401
-------------+---------------------------------+------------------------------
     overall |                                 |  .0757179
------------------------------------------------------------------------------
mc  = correlation between depvar and its prediction
mc2 = mc^2 is the Bentler-Raykov squared multiple correlation coefficient

Group #2 (sexmw=1; N=380)
Equation-level goodness of fit
------------------------------------------------------------------------------
             |                Variance               |
     depvars |    fitted  predicted   residual | R-squared        mc      mc2
-------------+---------------------------------+------------------------------
observed     |                                 |
     nontrad |  4.853467    .623241   4.230226 |  .1284115  .3583455  .1284115
      intern |   1.47542    .001949   1.473471 |   .001321  .0363455   .001321
      extern |  1.436124   .0027271   1.433397 |  .0018989  .0435769  .0018989
```

```
     hostile |  .5520505   .0065914   .5454591 |  .0119399  .1092697  .0119399
       benev |  .5866505   .0038386   .5828119 |  .0065432  .0808901  .0065432
-------------+---------------------------------+------------------------------
     overall |                                 |  .0283625
------------------------------------------------------------------------------
mc  = correlation between depvar and its prediction
mc2 = mc^2 is the Bentler-Raykov squared multiple correlation coefficient

----------------------------------------------------------------------------
Fit statistic        |      Value   Description
---------------------+------------------------------------------------------
Likelihood ratio     |
          chi2_ms(0) |      0.000   model vs. saturated
            p > chi2 |          .
         chi2_bs(30) |    399.257   baseline vs. saturated
            p > chi2 |      0.000
---------------------+------------------------------------------------------
Population error     |
               RMSEA |      0.000   Root mean squared error of approximation
 90% CI, lower bound |      0.000
         upper bound |      0.000
---------------------+------------------------------------------------------
Information criteria |
                 AIC |  10764.414   Akaike's information criterion
                 BIC |  10988.493   Bayesian information criterion
---------------------+------------------------------------------------------
Baseline comparison  |
                 CFI |      1.000   Comparative fit index
                 TLI |      1.000   Tucker-Lewis index
---------------------+------------------------------------------------------
Size of residuals    |
                  CD |      0.055   Coefficient of determination
----------------------------------------------------------------------------
Note: pclose is not reported because of multiple groups.
Note: SRMR is not reported because of missing values.


Tests for group invariance of parameters
-----------------------------------------------------------------------------------------
                       |              Wald Test                      Score Test
                       |       chi2          df    p>chi2       chi2          df    p>chi2
-----------------------+-----------------------------------------------------------------
Structural             |
  nontrad <-    intern |      0.458           1    0.4985          .           .         .
                extern |      0.058           1    0.8093          .           .         .
               hostile |      2.051           1    0.1521          .           .         .
                 benev |      0.000           1    0.9951          .           .         .
                 mindc |      0.779           1    0.3776          .           .         .
                 _cons |      0.060           1    0.8070          .           .         .
  ---------------------+-----------------------------------------------------------------
  intern <-      mindc |      5.137           1    0.0234          .           .         .
                 _cons |     21.432           1    0.0000          .           .         .
  ---------------------+-----------------------------------------------------------------
  extern <-      mindc |      3.109           1    0.0779          .           .         .
                 _cons |      2.527           1    0.1119          .           .         .
  ---------------------+-----------------------------------------------------------------
  hostile <-     mindc |      0.004           1    0.9476          .           .         .
                 _cons |     11.769           1    0.0006          .           .         .
  ---------------------+-----------------------------------------------------------------
  benev <-       mindc |     10.305           1    0.0013          .           .         .
                 _cons |     21.428           1    0.0000          .           .         .
-----------------------+-----------------------------------------------------------------
         var(e.nontrad)|      0.051           1    0.8218          .           .         .
          var(e.intern)|      4.011           1    0.0452          .           .         .
          var(e.extern)|      0.281           1    0.5961          .           .         .
         var(e.hostile)|      9.393           1    0.0022          .           .         .
           var(e.benev)|      0.353           1    0.5523          .           .         .
-----------------------+-----------------------------------------------------------------
```

```
 cov(e.intern,e.extern)|      0.377          1    0.5393          .           .         .
cov(e.intern,e.hostile)|     10.119          1    0.0015          .           .         .
  cov(e.intern,e.benev)|      2.147          1    0.1428          .           .         .
cov(e.extern,e.hostile)|      0.187          1    0.6652          .           .         .
  cov(e.extern,e.benev)|      0.001          1    0.9729          .           .         .
 cov(e.hostile,e.benev)|      2.557          1    0.1098          .           .         .
-----------------------------------------------------------------------------------------

.          // men and women indirect effect XtoM1toY
.          nlcom _b[intern:0bn.sexmw#c.mindc]*_b[nontrad:0bn.sexmw#c.intern]
       _nl_1:  _b[intern:0bn.sexmw#c.mindc]*_b[nontrad:0bn.sexmw#c.intern]
------------------------------------------------------------------------------
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .3470519   .1254253     2.77   0.006     .1012229     .592881
------------------------------------------------------------------------------

.          nlcom _b[intern:1.sexmw#c.mindc]*_b[nontrad:1.sexmw#c.intern]
       _nl_1:  _b[intern:1.sexmw#c.mindc]*_b[nontrad:1.sexmw#c.intern]
------------------------------------------------------------------------------
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .0442618   .0631597     0.70   0.483     -.079529    .1680526
------------------------------------------------------------------------------

.          // men and women indirect effect XtoM2toY
.          nlcom _b[extern:0bn.sexmw#c.mindc]*_b[nontrad:0bn.sexmw#c.extern]
       _nl_1:  _b[extern:0bn.sexmw#c.mindc]*_b[nontrad:0bn.sexmw#c.extern]
------------------------------------------------------------------------------
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .0129229   .0318837     0.41   0.685    -.0495681    .0754138
------------------------------------------------------------------------------

.          nlcom _b[extern:1.sexmw#c.mindc]*_b[nontrad:1.sexmw#c.extern]
       _nl_1:  _b[extern:1.sexmw#c.mindc]*_b[nontrad:1.sexmw#c.extern]
------------------------------------------------------------------------------
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |  -.0097521   .0162089    -0.60   0.547    -.0415209    .0220168
------------------------------------------------------------------------------

.          // men and women indirect effect XtoM3toY
.          nlcom _b[hostile:0bn.sexmw#c.mindc]*_b[nontrad:0bn.sexmw#c.hostile]
       _nl_1:  _b[hostile:0bn.sexmw#c.mindc]*_b[nontrad:0bn.sexmw#c.hostile]
------------------------------------------------------------------------------
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .1449251   .1080397     1.34   0.180    -.0668289     .356679
------------------------------------------------------------------------------

.          nlcom _b[hostile:1.sexmw#c.mindc]*_b[nontrad:1.sexmw#c.hostile]
       _nl_1:  _b[hostile:1.sexmw#c.mindc]*_b[nontrad:1.sexmw#c.hostile]
------------------------------------------------------------------------------
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .0969775   .0527961     1.84   0.066     -.006501     .200456
------------------------------------------------------------------------------

.          // men and women indirect effect XtoM4toY
.          nlcom _b[benev:0bn.sexmw#c.mindc]*_b[nontrad:0bn.sexmw#c.benev]
       _nl_1:  _b[benev:0bn.sexmw#c.mindc]*_b[nontrad:0bn.sexmw#c.benev]
------------------------------------------------------------------------------
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   .0495176   .0529333     0.94   0.350    -.0542298     .153265
------------------------------------------------------------------------------
```

```
.         nlcom _b[benev:1.sexmw#c.mindc]*_b[nontrad:1.sexmw#c.benev]
       _nl_1:  _b[benev:1.sexmw#c.mindc]*_b[nontrad:1.sexmw#c.benev]
------------------------------------------------------------------------------
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       _nl_1 |   -.022023   .0243101    -0.91   0.365      -.06967     .025624
------------------------------------------------------------------------------
```

SAS PROC CALIS Multiple-Group Path Model (XtoM1toY path now equal across genders):
only new parts of code shown

```
TITLE1 "Multiple-Group Path Model -- XtoM1toY equal by gender";
TITLE2 "Model chi-square provides test of 2 new constraints";
  MODEL 1 / GROUP=1;
  PATH MindC ---> NonTrad = wXtoY,
       MindC ---> Intern Extern Hostile Benev = XtoM1 mXtoM2 mXtoM3 mXtoM4,
       Intern Extern Hostile Benev ---> NonTrad = M1toY mM2toY mM3toY mM4toY;
  MODEL 2 / GROUP=2;
  PATH MindC ---> NonTrad = wXtoY,
       MindC ---> Intern Extern Hostile Benev = XtoM1 wXtoM2 wXtoM3 wXtoM4,
       Intern Extern Hostile Benev ---> NonTrad = M1toY wM2toY wM3toY wM4toY;
```

MPLUS Multiple-Group Path Model (XtoM1toY path now equal across genders):
only new parts of code shown

```
MODEL:
  Intern   ON Mind1C (XtoM1);
  NonTrad ON Intern  (M1toY);
MODEL Women:
  Intern   ON Mind1C (XtoM1);
  NonTrad ON Intern  (M1toY);
```

STATA SEM Multiple-Group Path Model (all parameters separate by gender):
only new parts of code shown

```
display as result "Multiple group path model omitting coeflegened"
display as result "Testing equality of indirect effect XtoM1toY"
display as result "Model chi-square gives test of 2 new constraints"
sem (mindc -> nontrad)                                   /// XtoY
    (0: mindc -> intern@a extern hostile benev)          /// XtoM1,M2,M3,M4 for group0
    (1: mindc -> intern@a extern hostile benev)          /// XtoM1,M2,M3,M4 for group1
    (0: nontrad <- intern@b extern hostile benev)        /// M1,M2,M3,M4toY for group0
    (1: nontrad <- intern@b extern hostile benev),       /// M1,M2,M3,M4toY for group1
```

STATA SEM unstandardized output for a Multiple-Group Path Model (*relevant parts only*):

```
Log likelihood     = -5334.9925
 ( 1)  [nontrad]0bn.sexmw#c.intern - [nontrad]1.sexmw#c.intern = 0
 ( 2)  [intern]0bn.sexmw#c.mindc - [intern]1.sexmw#c.mindc = 0
---------------------------------------------------------------------------------------
                       |                 OIM
                       |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-----------------------+---------------------------------------------------------------
Structural             |
  nontrad <-           |
                intern |
                   [*] |   .4923674   .0727678     6.77   0.000     .3497452    .6349897
  ---------------------+---------------------------------------------------------------
  intern <-            |
                 mindc |
                   [*] |    .283537   .1135763     2.50   0.013     .0609316    .5061425
-----------------------+---------------------------------------------------------------
Note: [*] identifies parameter estimates constrained to be equal across groups.
LR test of model vs. saturated: chi2(2)   =      5.57, Prob > chi2 = 0.0617
```