Multivariate Difference Score Models via MLM in SAS and Path Models in Mplus

Souce: Gervais, S. J., Vescio, T. K., & Allen, J. (2011). When what you see if what you get: The consequences of the objectifying gaze for women and men. *Psychology of Women Quarterly, 35*(1), 5-17.

One minor question in this paper focused on gender differences in how discrepant the people felt their bodies were from their own ideals. To measure this, participants completed the Figure Rating Scale, which has pictures of nine bodies varying from extremely thin (1) to extremely overweight (9). Participants provided one rating for their *ideal* body and another for their *actual* body. Thus, the focus of the analysis was the difference score between these ideal and actual ratings for each person. Using a difference score as a DV is highly problematic, in that all information about the absolute amount of the original variables is lost. Here is a better way through a multivariate regression in MLM or as a path model in Mplus. For comparability across programs, I used ML (although the results in the paper are from REML).

SAS Data Set-Up, Syntax, and Output:

```
* Stacking data into one row per person per DV;
DATA object2; SET obj2tot;
       dv="ideal "; body=body1; OUTPUT;
       dv="actual"; body=body5; OUTPUT;
RUN; PROC SORT DATA=object2; BY pin dv; RUN;

TITLE "Difference between Ideal and Actual Figure Rating Scale";
PROC MIXED DATA=object2 NOCLPRINT NOITPRINT COVTEST IC NAMELEN=50 METHOD=ML;
       CLASS pin dv sex;
       MODEL body = sex|dv /SOLUTION DDFM=Satterthwaite;
       REPEATED dv / R RCORR TYPE=UN SUBJECT=pin;
       LSMEANS sex dv sex*dv / DIFF=ALL;
RUN;
```

```
Estimated R Matrix for pin 100      Estimated R Correlation Matrix for pin 100
 Row        Col1        Col2        Row        Col1        Col2
   1      4.2671      1.8958          1      1.0000      0.9362
   2      1.8958      0.9610          2      0.9362      1.0000

                Covariance Parameter Estimates
                                  Standard         Z
Cov Parm    Subject    Estimate       Error     Value        Pr Z
UN(1,1)     pin          4.2671      0.4927      8.66      <.0001
UN(2,1)     pin          1.8958      0.2265      8.37      <.0001
UN(2,2)     pin          0.9610      0.1110      8.66      <.0001

                          Information Criteria
Neg2LogLike    Parms        AIC       AICC       HQIC        BIC       CAIC
      749.3        7      763.3      763.7      771.9      784.4      791.4
```

Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F	
sex	1	148	0.14	0.7124	No MARGINAL effect of sex (don't know what it means anyway)
dv	1	148	16.27	<.0001	MARGINAL effect of body discrepancy (i.e., for non-gendered person)
dv*sex	1	148	17.27	<.0001	Interaction

Solution for Fixed Effects

Effect	dv	sex	Estimate	Standard Error	DF	t Value	Pr > |t|	
Intercept			4.1687	0.1076	150	38.74	<.0001	Mean ideal body rating for men
sex		f	-0.3179	0.1610	150	-1.97	0.0501	How much lighter women think they should be than men
sex		m	0	.	.	.	.	
dv	actual		-0.01205	0.1316	150	-0.09	0.9272	How much lighter men actually are than their ideal
dv	ideal		0	.	.	.	.	
dv*sex	actual	f	0.8180	0.1968	150	4.16	<.0001	Difference between ideal and actual is bigger for women
dv*sex	actual	m	0	.	.	.	.	
dv*sex	ideal	f	0	.	.	.	.	
dv*sex	ideal	m	0	.	.	.	.	

Least Squares Means

Effect	dv	sex	Estimate	Standard Error	DF	t Value	Pr > |t|
sex		f	4.2537	0.1847	148	23.03	<.0001
sex		m	4.1627	0.1659	148	25.09	<.0001
dv	actual		4.4067	0.1708	148	25.80	<.0001
dv	ideal		4.0097	0.08104	148	49.48	<.0001
dv*sex	actual	f	4.6567	0.2541	148	18.33	<.0001
dv*sex	actual	m	4.1566	0.2283	148	18.21	<.0001
dv*sex	ideal	f	3.8507	0.1206	148	31.94	<.0001
dv*sex	ideal	m	4.1687	0.1083	148	38.48	<.0001

	Female	Male	Non-Gender
Ideal	**3.85**	4.17	4.01
Actual	4.66	4.16	4.41
??	4.25	4.16	

Differences of Least Squares Means

Effect	dv	sex	_dv	_sex	Estimate	Standard Error	DF	t Value	Pr > |t|	
sex		f		m	0.09108	0.2483	148	0.37	0.7143	??
dv	actual		ideal		0.3970	0.09908	148	4.01	<.0001	How much higher actual is from ideal for non-gender
dv*sex	actual	f	actual	m	0.5001	0.3415	148	1.46	0.1453	Men actual is not heavier than women actual
dv*sex	actual	f	ideal	f	0.8060	0.1474	148	5.47	<.0001	Women think they are heavier than their ideal
dv*sex	actual	f	ideal	m	0.4880	0.2762	153	1.77	0.0792	??
dv*sex	actual	m	ideal	f	0.3059	0.2582	155	1.18	0.2379	??
dv*sex	actual	m	ideal	m	-0.01205	0.1324	148	-0.09	0.9276	Men don't think they are different than ideal
dv*sex	ideal	f	ideal	m	-0.3179	0.1621	148	-1.9	0.0517	Women think their ideal is skinnier than men do

Mplus Syntax and Output (slight differences relative to SAS because the sex interaction term is not officially in the model):

```
TITLE:  Multivariate regression for difference scores;
DATA:   FILE = diffscore.csv; ! Can just list file if in same directory;
        FORMAT = free;        ! FREE or FIXED format;
        TYPE = individual;    ! Individual or matrix data as input;

VARIABLE:
! List of ALL variables in stacked data file, in order;
! Mplus does NOT know what they used to be called, though;
    NAMES ARE pin female ideal actual;
! List of ALL variables used in model (DEFINED variables at end);
    USEVARIABLES ARE female ideal actual;
! Missing data codes (here, -999);
    MISSING ARE ALL (-999);

ANALYSIS:   TYPE IS GENERAL;        ! Used for path models;
            ESTIMATOR IS ML;        ! Can use MLR for non-normality;

MODEL:
! ON = y outcomes ON x predictors;
ideal ON female*  (fONide);
actual ON female* (fONact);
[ideal*]        (malidemn);         ! Intercept for ideal for men;
[actual*]       (malactmn);         ! Intercept for actual for men;

! Residual covariances (like TYPE=UN R via REPEATED in PROC MIXED);
ideal WITH actual*;

! Getting all simple effects and interaction;
MODEL CONSTRAINT:
NEW (dvdif4M dvdif4W sexint);
dvdif4M = malidemn - malactmn;                    ! Diff score for men;
dvdif4W = malidemn - malactmn + fONide -  fONact;  ! Diff score for women;
sexint = fONide - fONact;                         ! Sex diff in diff
score;
```

```
MODEL FIT INFORMATION  is not relevant; model is saturated


MODEL RESULTS
                                                              Two-Tailed
                    Estimate       S.E.  Est./S.E.    P-Value

 IDEAL    ON
    FEMALE            -0.330      0.160     -2.063      0.039

 ACTUAL   ON
    FEMALE             0.490      0.337      1.456      0.146

 IDEAL    WITH
    ACTUAL             1.887      0.225      8.394      0.000

 Intercepts
    IDEAL              4.169      0.108     38.774      0.000
    ACTUAL             4.157      0.226     18.387      0.000

 Residual Variances
    IDEAL              0.959      0.110      8.689      0.000
    ACTUAL             4.242      0.488      8.689      0.000

 New/Additional Parameters
    DVDIF4M            0.012      0.131      0.092      0.927
    DVDIF4W           -0.809      0.145     -5.583      0.000
    SEXINT            -0.821      0.195     -4.201      0.000
```

Example result section using ML estimates from SAS:

The extent to which the difference between ideal body size and actual body size varied by gender was examined in 150 college students. Both body rating outcomes were measured on a scale of 1 to 9, with higher scores indicating larger bodies. Given that the body rating outcomes were correlated within persons, a multivariate regression model was used to predict both outcomes for each person simultaneously, such that the model included separate residual variances and a residual covariance across outcomes from the same person. The means for each combination of outcome by sex are provided in Table 1. There was a significant interaction between gender and body rating, $F(1,148) = 17.27$, $p < .001$, whose pattern can be understood as follows. Although men and women did not differ in their estimates of actual body size (men = 4.16 vs. women = 4.66, $p = .145$), men thought their ideal body should be marginally heavier than women did (men = 4.66 vs. women = 3.85, $p = .052$). In addition, although men did not think they were different from their ideal on average (actual= 4.16 vs. ideal= 4.17, $p = .928$), women thought they were significantly heavier than their actual (actual = 4.66 vs. ideal = 3.85, $p < .001$).