Dingy Output

Tests of Distinguishability and Nonindependence
November 27, 2015

1. Text

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Tests of Distinguishability

The focus is to determine whether Gender makes a statistical difference in the data, and if it does, what is that difference. That is, are there differences between Husbands and Wives for the mixed variables Other Positivity, Self Positivity, Similar Hobbies, and Satisfaction, the between-dyads variable Years Married, and the within-dyads variable Tension Difference? There are 148 dyads in the sample and no missing data. The mixed variables in the dataset for Husbands are OtherPos_H, SelfPos_H, SimHob_H, and Satisfaction_H, the variables for Wives are OtherPos_W, SelfPos_W, SimHob_W, and Satisfaction_W, and their names for the text are Other Positivity, Self Positivity, Similar Hobbies, and Satisfaction. The between-dyads variable in the dataset is yearsmar and its name for the text is Years Married. The within-dyads variable in the dataset for Husbands is Tdiff_H and for Wives is Tdiff_W,and its name in the text is Tension Difference. The analyses employ the method of structural equation modeling using the computer program of lavaan. The means and standard deviations of each variable for both Husbands and Wives are presented in Table 1. Note that the estimates are maximum likelihood estimates and so the standard deviations are a bit larger than conventional estimates.

There are three ways in which Gender can make a difference. They are differences between the variables in their means, in their variances, and differences between correlations between the two variables. To test if correlations differ, the variances must be set equal for the two members. Note too that the correlations may differ, but cross-variable effects (e.g., actor and partner effects in the Actor-Partner Interdependence Model) might not differ. For a within-dyads variable the correlations whould be equal across members but their signs would be different. For instance, the means and variances of Other Positivity might differ for Husbands and Wives. Also for the within-dyads variable of Tension Difference the means for both Husbands and Wives would not both equal 2.000. For correlation, an example is that the correlations between Other Positivity and Self Positivity might be different for Husbands and Wives. Another example is that the correlations between Other Positivity and Years Married or with Tension Difference might be different for Husbands and Wives.

Tables 2 and 3 provide the measures of fit for five models which allow for different types of distinguishability and also there is a table of the tests of hypotheses. (To learn about measures of fit go to davidakenny.net/cm/fit.htm -- reverse the slashes. The RMSEA must be less than 0.08 to be considered a good-fitting model.) To begin, the test that the means for each variable are equal (Model I versus Model II) is statistically significant (chi-square(5) = 46.58, p < .001). Thus, there is evidence that the means are unequal. Next, the test of whether the correlations between pairs of variables are equal (Model I versus Model III) is not statistically significant (chi-square(20) = 18.52, p = .553). Thus, the data are consistent with the hypothesis that the correlations are equal, given that the variances are equal. Lastly, the test that the variances are equal (Model IV versus Model V) is statistically significant (chi-square(4) = 10.10, p = .039). Thus, there is evidence that the variances are unequal. In terms of fit indices, the Means Unequal Model or Model II appears to be the best model as it has the lowest value of the RMSEA and the SABIC.

The model of complete indistinguishability is called the I-Sat model by Olsen and Kenny (2006) and that model has a chi square of 75.636 with 29 degrees of freedom. The null model for the indistinguishable case (the model that fixes all correlations to zero, but frees the means and variances and sets them equal across the two members) is 299.528 with 44 degrees of freedom.

Test of Nonindependence

Additionally, the question is whether the scores of the Husbands and Wives are correlated, i.e., nonindependent. There are 16 correlations between the scores of Husbands and Wives, and the null hypothesis is that these correlations are all zero. The effects due to the between-dyads variables have been removed in tests of nonindependence. Table 4 contains the results from these tests. (Note that SABIC(Sat) refers to the SABIC for the saturated model. Also for the RMSEA 0.08 is used as the cutoff for a good fitting model. Treating dyad members as distinguishable, there is good evidence that there is nonindependence or correlation between the scores of Husbands and Wives. Alternatively, if we treat dyad members as indistinguishable, there is good evidence that there is nonindependence or correlation between the scores of Husbands and Wives.

2. Tables

Table 1: Descriptive Statistics for Husbands and Wives

Person	Husbands		Wives	
	Mean	SD	Mean	SD
Other Positivity	4.281	0.472	4.246	0.521
Self Positivity	4.082	0.389	4.291	0.408
Similar Hobbies	-0.034	0.682	0.189	0.585
Satisfaction	3.618	0.460	3.591	0.528
Years Married	-0.000	7.694	-0.000	7.694
Tension Difference	1.821	0.782	2.179	0.782

Table 2: Tests of Different Types of Distinguishability

Model	Equal Means	Equal Variances	Equal Correlations	chi square	df	p	RMSEA	SABIC
I	Yes	Yes	Yes	75.636	29	<.001	0.104	121.451
II	No	Yes	Yes	29.053	24	.218	0.038	84.031
III	Yes	Yes	No	57.115	9	<.001	0.190	139.582
IV	No	Yes	No	10.096	4	.039	0.101	101.725
V	No	No	No		0			98.959

Table 3: Tests of Hypotheses of Different Types of Distinguishability

	Test	chi square	df	p value
Means	I versus II	46.583	5	<.001
Correlations	I versus III	18.521	20	.553
Variances	IV versus V	10.096	4	.039

Table 4: Tests of Nonindependence across Husbands and Wives

	chi square	df	p value	RMSEA	SABIC	SABIC(Sat)
Distinguishable	115.362	16	<.001	0.205	185.000	98.959
Indistinguishable	102.966	10	<.001	0.251	130.454	45.815

3. lavaan Output

Test of Distinguishability or the I-SAT Model

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lavaan (0.5-16) converged normally after 353 iterations

  Number of observations                           148

  Number of missing patterns                         1

  Estimator                                         ML
  Minimum Function Test Statistic               75.636
  Degrees of freedom                                29
  P-value (Chi-square)                           0.000
```

	lhs	op	rhs	label	est	se	z	pvalue
1	OtherPos_W	~1		m1	4.264	0.032	1.32841e+02	0.000
2	OtherPos_H	~1		m1	4.264	0.032	1.32841e+02	0.000
3	OtherPos_W	~~	OtherPos_W	v1	0.248	0.021	1.18520e+01	0.000
4	OtherPos_H	~~	OtherPos_H	v1	0.248	0.021	1.18520e+01	0.000
5	OtherPos_W	~~	OtherPos_H		0.057	0.021	2.74400e+00	0.006
6	SelfPos_W	~1		m2	4.186	0.025	1.68056e+02	0.000
7	SelfPos_H	~1		m2	4.186	0.025	1.68056e+02	0.000
8	SelfPos_W	~~	SelfPos_W	v2	0.170	0.014	1.21230e+01	0.000
9	SelfPos_H	~~	SelfPos_H	v2	0.170	0.014	1.21230e+01	0.000
10	SelfPos_W	~~	SelfPos_H		0.014	0.014	1.01100e+00	0.312
11	SimHob_W	~1		m3	0.078	0.042	1.83300e+00	0.067
12	SimHob_H	~1		m3	0.078	0.042	1.83300e+00	0.067
13	SimHob_W	~~	SimHob_W	v3	0.416	0.036	1.17220e+01	0.000
14	SimHob_H	~~	SimHob_H	v3	0.416	0.036	1.17220e+01	0.000
15	SimHob_W	~~	SimHob_H		0.116	0.036	3.25500e+00	0.001
16	Satisfaction_W	~1		m4	3.605	0.037	9.84310e+01	0.000
17	Satisfaction_H	~1		m4	3.605	0.037	9.84310e+01	0.000
18	Satisfaction_W	~~	Satisfaction_W	v4	0.246	0.024	1.03560e+01	0.000
19	Satisfaction_H	~~	Satisfaction_H	v4	0.246	0.024	1.03560e+01	0.000
20	Satisfaction_W	~~	Satisfaction_H		0.151	0.024	6.38300e+00	0.000
21	OtherPos_H	~~	SelfPos_W	c12	0.050	0.013	3.89800e+00	0.000

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22     OtherPos_W ~~      SelfPos_H   c12  0.050 0.013  3.89800e+00  0.000
23     OtherPos_H ~~      SelfPos_H   p12  0.050 0.013  3.95100e+00  0.000
24     OtherPos_W ~~      SelfPos_W   p12  0.050 0.013  3.95100e+00  0.000
25     OtherPos_H ~~       SimHob_W   c13  0.049 0.020  2.48800e+00  0.013
26     OtherPos_W ~~       SimHob_H   c13  0.049 0.020  2.48800e+00  0.013
27     OtherPos_H ~~       SimHob_H   p13  0.057 0.020  2.89900e+00  0.004
28     OtherPos_W ~~       SimHob_W   p13  0.057 0.020  2.89900e+00  0.004
29     OtherPos_H ~~ Satisfaction_W   c14  0.094 0.018  5.35400e+00  0.000
30     OtherPos_W ~~ Satisfaction_H   c14  0.094 0.018  5.35400e+00  0.000
31     OtherPos_H ~~ Satisfaction_H   p14  0.116 0.018  6.56900e+00  0.000
32     OtherPos_W ~~ Satisfaction_W   p14  0.116 0.018  6.56900e+00  0.000
33      SelfPos_H ~~       SimHob_W   c23  0.001 0.016  6.70000e-02  0.946
34      SelfPos_W ~~       SimHob_H   c23  0.001 0.016  6.70000e-02  0.946
35      SelfPos_H ~~       SimHob_H   p23  0.016 0.016  1.01700e+00  0.309
36      SelfPos_W ~~       SimHob_W   p23  0.016 0.016  1.01700e+00  0.309
37      SelfPos_H ~~ Satisfaction_W   c24  0.012 0.012  9.97000e-01  0.319
38      SelfPos_W ~~ Satisfaction_H   c24  0.012 0.012  9.97000e-01  0.319
39      SelfPos_H ~~ Satisfaction_H   p24  0.037 0.012  3.00800e+00  0.003
40      SelfPos_W ~~ Satisfaction_W   p24  0.037 0.012  3.00800e+00  0.003
41       SimHob_H ~~ Satisfaction_W   c34  0.072 0.021  3.38500e+00  0.001
42       SimHob_W ~~ Satisfaction_H   c34  0.072 0.021  3.38500e+00  0.001
43       SimHob_H ~~ Satisfaction_H   p34  0.092 0.021  4.31300e+00  0.000
44       SimHob_W ~~ Satisfaction_W   p34  0.092 0.021  4.31300e+00  0.000
45       yearsmar ~1                  mm1 -0.117 0.640 -1.83000e-01  0.855
46       yearsmar ~~       yearsmar   vv1 59.128 6.864  8.61400e+00  0.000
47     OtherPos_H ~~       yearsmar  cc11  0.513 0.250  2.05600e+00  0.040
48     OtherPos_W ~~       yearsmar  cc11  0.513 0.250  2.05600e+00  0.040
49      SelfPos_H ~~       yearsmar  cc12  0.247 0.193  1.28200e+00  0.200
50      SelfPos_W ~~       yearsmar  cc12  0.247 0.193  1.28200e+00  0.200
51       SimHob_H ~~       yearsmar  cc13 -0.440 0.328 -1.34300e+00  0.179
52       SimHob_W ~~       yearsmar  cc13 -0.440 0.328 -1.34300e+00  0.179
53 Satisfaction_H ~~       yearsmar  cc14 -0.005 0.281 -1.90000e-02  0.985
54 Satisfaction_W ~~       yearsmar  cc14 -0.005 0.281 -1.90000e-02  0.985
55        Tdiff_H ~1                 mmm1  2.000 0.000  7.70398e+08  0.000
56        Tdiff_H ~~        Tdiff_H  vvv1  0.646 0.075  8.57200e+00  0.000
57       yearsmar ~~        Tdiff_H       -0.494 0.471 -1.04800e+00  0.295
58     OtherPos_H ~~        Tdiff_H ccc11 -0.032 0.021 -1.55100e+00  0.121
59     OtherPos_W ~~        Tdiff_H ccd11  0.032 0.021  1.55100e+00  0.121
60      SelfPos_H ~~        Tdiff_H ccc12  0.002 0.018  1.24000e-01  0.901
61      SelfPos_W ~~        Tdiff_H ccd12 -0.002 0.018 -1.24000e-01  0.901
62       SimHob_H ~~        Tdiff_H ccc13 -0.012 0.026 -4.80000e-01  0.632
63       SimHob_W ~~        Tdiff_H ccd13  0.012 0.026  4.80000e-01  0.632
64 Satisfaction_H ~~        Tdiff_H ccc14 -0.064 0.015 -4.22100e+00  0.000
65 Satisfaction_W ~~        Tdiff_H ccd14  0.064 0.015  4.22100e+00  0.000
66           mmm1 ==              2        0.000 0.000           NA     NA
67          ccc11 ==         -ccd11        0.000 0.000           NA     NA
68          ccc12 ==         -ccd12        0.000 0.000           NA     NA
69          ccc13 ==         -ccd13        0.000 0.000           NA     NA
70          ccc14 ==         -ccd14        0.000 0.000           NA     NA
   ci.lower ci.upper std.lv std.all
1     4.201    4.326  4.264   8.568
2     4.201    4.326  4.264   8.568
3     0.207    0.289  0.248   1.000
4     0.207    0.289  0.248   1.000
```

5	0.016	0.098	0.057	0.232
6	4.138	4.235	4.186	10.167
7	4.138	4.235	4.186	10.167
8	0.142	0.197	0.170	1.000
9	0.142	0.197	0.170	1.000
10	-0.013	0.042	0.014	0.083
11	-0.005	0.161	0.078	0.120
12	-0.005	0.161	0.078	0.120
13	0.347	0.486	0.416	1.000
14	0.347	0.486	0.416	1.000
15	0.046	0.185	0.116	0.278
16	3.533	3.677	3.605	7.274
17	3.533	3.677	3.605	7.274
18	0.199	0.292	0.246	1.000
19	0.199	0.292	0.246	1.000
20	0.105	0.198	0.151	0.616
21	0.025	0.074	0.050	0.242
22	0.025	0.074	0.050	0.242
23	0.025	0.075	0.050	0.245
24	0.025	0.075	0.050	0.245
25	0.010	0.088	0.049	0.153
26	0.010	0.088	0.049	0.153
27	0.019	0.096	0.057	0.178
28	0.019	0.096	0.057	0.178
29	0.060	0.129	0.094	0.382
30	0.060	0.129	0.094	0.382
31	0.081	0.150	0.116	0.469
32	0.081	0.150	0.116	0.469
33	-0.030	0.032	0.001	0.004
34	-0.030	0.032	0.001	0.004
35	-0.015	0.047	0.016	0.060
36	-0.015	0.047	0.016	0.060
37	-0.012	0.037	0.012	0.060
38	-0.012	0.037	0.012	0.060
39	0.013	0.061	0.037	0.182
40	0.013	0.061	0.037	0.182
41	0.030	0.113	0.072	0.225
42	0.030	0.113	0.072	0.225
43	0.050	0.133	0.092	0.286
44	0.050	0.133	0.092	0.286
45	-1.371	1.136	-0.117	-0.015
46	45.675	72.582	59.128	1.000
47	0.024	1.002	0.513	0.134
48	0.024	1.002	0.513	0.134
49	-0.131	0.624	0.247	0.078
50	-0.131	0.624	0.247	0.078
51	-1.082	0.202	-0.440	-0.089
52	-1.082	0.202	-0.440	-0.089
53	-0.556	0.546	-0.005	-0.001
54	-0.556	0.546	-0.005	-0.001
55	2.000	2.000	2.000	2.488
56	0.499	0.794	0.646	1.000
57	-1.418	0.430	-0.494	-0.080
58	-0.072	0.008	-0.032	-0.080

59	-0.008	0.072	0.032	0.080
60	-0.034	0.038	0.002	0.007
61	-0.038	0.034	-0.002	-0.007
62	-0.062	0.038	-0.012	-0.024
63	-0.038	0.062	0.012	0.024
64	-0.094	-0.035	-0.064	-0.162
65	0.035	0.094	0.064	0.162
66	0.000	0.000	0.000	0.488
67	0.000	0.000	0.000	0.000
68	0.000	0.000	0.000	0.000
69	0.000	0.000	0.000	0.000
70	0.000	0.000	0.000	0.000