1-way MANOVA

There are a couple of things to look at before jumping into the MANOVA…

Correlations among the DVs

What is a "good set of DVs" for a MANOVA? There are some differing opinions! One approach suggests that the DVs should be highly correlated, so that he MANOVA variate represents a "cleaned up" version of the underlying construct. Another approach is that the DVs should have relatively low correlations, so that the set of DVs "covers more constructs". One interesting tendency is that DV sets chosen according to the first approach tend to show a concentrated structure (a single significant MANOVA variate), while the those chosen using the second approach are more likely to produce a diffuse structure (two or more MANOVA variates).

For these variables…

These DVS are not highly correlated!

We get a common result that #correct and response time are negatively correlated, but share less than 25% of their variance.

The other correlations are lower (but not significant, largely because of the small sample size).

So, depending on their relative relationships to the IV, these DVs could easily produce a diffuse structure.

Correlations

		# correct	# atttempted	response time
# correct	Pearson Correlation	1	.273	-.468**
	Sig. (2-tailed)		.145	.009
	N	30	30	30
# atttempted	Pearson Correlation	.273	1	-.299
	Sig. (2-tailed)	.145		.109
	N	30	30	30
response time	Pearson Correlation	-.468**	-.299	1
	Sig. (2-tailed)	.009	.109	
	N	30	30	30

**. Correlation is significant at the 0.01 level (2-tailed).

ANOVAs on each DV

There are two good reasons to do these ANOVAs before moving on the MANOVA. First, you can somewhat anticipate the multivariate results from the ANOVAs. If the different DVs show the same pairwise patterns of group differences, you can expect a concentrated structure. Second, you will be able to notice and work to interpret if you have a suppressor effect, either a "simple suppressor" in which a DV with a nonsignificant group difference contributes to a significant multivariate effect, or a "complex suppressor" in which a DV has both a bivariate relationship and a multivariate contribution, but in opposite directions.

For these variables (with the output cleaned up a bit) …

Descriptives

		N	Mean	Std. Deviation
# correct	praise	10	7.3693	2.19202
	criticism	10	4.7695	3.35615
	silence	10	4.2438	1.98388
	Total	30	5.4609	2.85304
# atttempted	praise	10	13.2828	5.95531
	criticism	10	7.4580	5.27526
	silence	10	8.2516	3.68500
	Total	30	9.6641	5.54428
response time	praise	10	8.3863	2.28458
	criticism	10	14.8611	6.88475
	silence	10	7.5756	2.56347
	Total	30	10.2743	5.41892

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
# correct	Between Groups	56.015	2	28.008	4.200	.026
	Within Groups	180.041	27	6.668		
	Total	236.056	29			
# atttempted	Between Groups	199.573	2	99.786	3.894	.033
	Within Groups	691.861	27	25.624		
	Total	891.433	29			
response time	Between Groups	318.863	2	159.432	8.081	.002
	Within Groups	532.714	27	19.730		
	Total	851.577	29			

Multiple Comparisons

LSD

Dependent Variable	(I) rein	(J) rein	Mean Difference (I-J)	Sig.
# correct	praise	criticism	2.59988	.033
		silence	3.12552	.012
	criticism	silence	.52564	.653
# atttempted	praise	criticism	5.82481	.016
		silence	5.03127	.035
	criticism	silence	-.79354	.729
response time	praise	criticism	-6.47478	.003
		silence	.81075	.686
	criticism	silence	7.28552	.001

correct Praise > Criticism = Silence

attempted Praise > Criticism = Silence

response time Criticism > Praise = Silence

The differential pairwise pattern suggests we will find a diffuse multivariate structure in the MANOVA.

The 1-way MANOVA (fnally)

Using MANOVA currently requires the use of syntax code …

```
manova numcor numtry resptime by rein (1, 3)
 / print = signif (multiv, univ, eigen, dimenr)
 / discrim stan cor.
```

← list DVs **by** IV(s) (with min & max grps)
← gets various goodies
← don't forget the period !

```
 EFFECT .. REIN
 Multivariate Tests of Significance (S = 2, M = 0, N = 11 1/2)

 Test Name         Value  Approx. F Hypoth. DF   Error DF  Sig. of F

 Pillais          .81738    5.99004       6.00      52.00       .000
 Hotellings      1.42136    5.68542       6.00      48.00       .000
 Wilks            .34566    5.84075       6.00      50.00       .000
 Roys             .47185
 Note.. F statistic for WILKS' Lambda is exact.


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 Eigenvalues and Canonical Correlations

 Root No.    Eigenvalue        Pct.   Cum. Pct.  Canon Cor.

        1          .893      62.856      62.856        .687
        2          .528      37.144     100.000        .588


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 Dimension Reduction Analysis

 Roots        Wilks L.          F Hypoth. DF   Error DF  Sig. of F

 1 TO 2         .34566    5.84075       6.00      50.00       .000
 2 TO 2         .65447    6.86327       2.00      26.00       .004
```

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EFFECT .. REIN (Cont.)
Univariate F-tests with (2,27) D. F.

Variable	Hypoth. SS	Error SS	Hypoth. MS	Error MS	F	Sig. of F
NUMCOR	56.01525	180.04054	28.00762	6.66817	4.20020	.026
NUMTRY	199.57255	691.86066	99.78627	25.62447	3.89418	.033
RESPTIME	318.86314	532.71385	159.43157	19.73014	8.08061	.002

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EFFECT .. REIN (Cont.)
Standardized discriminant function coefficients

	Function No.	
Variable	1	2
NUMCOR	.117	.472
NUMTRY	.293	.631
RESPTIME	.792	-.093

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* * * * * * A n a l y s i s o f V a r i a n c e -- design 1 * * * * * *

EFFECT .. REIN (Cont.)
Correlations between DEPENDENT and canonical variables

	Canonical Variable	
Variable	1	2
NUMCOR	.263	.687
NUMTRY	.101	.727
RESPTIME	.612	-.107

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MANOVA variate #1 is dominated by Response Time, while variate #2 is a combination of Number Correct and Number Try.

Follow-up Analyses

Both variates are significant, but we don't know which groups are significantly different on which variates. We could re-analyze the data as an ldf and use the save command there to construct the variates, but since that approach won't work with factorial designs… this is a chance to learn how to do it by hand!

First we get the Z-score version of each DV.

Analyze → Descriptive Statistics → Descriptives
- Highlight and move the DVs
- Check the "Save standardized variables as variates" box

Then, using the standardized discriminant function coefficients from above, compose a compute statement for each significant variate.

Compute rein_1 = (znumcor * .117) + (znumtry * .293) + (zresptime * .792).
Compute rein_2 = (znumcor * .472) + (znumtry * .631) + (zresptime * -.093).

Now just do an ANOVA for each, and follow-up with LSD as you normally would…

Descriptives

		N	Mean	Std. Deviation
rein_1	praise	10	-.0064	.48971
	criticism	10	.5254	.79947
	silence	10	-.5190	.43675
	Total	30	.0000	.72116
rein_2	praise	10	.7600	.68576
	criticism	10	-.4442	1.02642
	silence	10	-.3158	.54923
	Total	30	.0000	.93172

Multiple Comparisons

LSD

Dependent Variable	(I) rein	(J) rein	Mean Difference (I-J)	Sig.
rein_1	praise	criticism	-.53188	.257
		silence	.51256	.166
	criticism	silence	1.04443	.001
rein_2	praise	criticism	1.20416	.002
		silence	1.07578	.005
	criticism	silence	-.12839	.716

Putting it together

We got the expected diffuse structure, with no suppressor effects.

MANOVA variate 1 (interpretively Response Time) Criticism = Praise = Silence (Criticism > Silence)
This one a little more complicated – they don't line up…

MANOVA variate 2 (interpretively #Correct & #Try) Praise > Criticism = Silence