MIXED MODEL ANOVA

To perform a factorial ANOVA with between- and within-subjects factors, the command is much like that for the repeated measures ANOVA. Specify the variables that represent the levels of the within-subjects factor (here, ach1 to ach5) and then the variable that represents the between-subjects factor (here, sex). The subcommands are identical to those from the repeated measures ANOVA. On the second line, provide a label for the within-subjects factor (here, accuracy) that is not itself a variable name but is less than 8 characters, and then state the number of levels of that factor (here, 5). The third line requests descriptive statistics for each level of each factor. On the fourth line, restate the name of the within-subjects factor (here, accuracy).

```
glm ach1 ach2 ach3 ach4 ach5 by sex
   /wsfactor accuracy 5
   /print desc
   /wsdesign accuracy .
```

You should skip over some portions of the output, concerning yourself only with Descriptive Statistics, Tests of Within-Subjects Effects, and Tests of Between-Subjects Effects.

General Linear Model

Within-Subjects Factors

Measure: MEASURE_1

ACCURACY	Dependent Variable
1	ACH1
2	ACH2
3	ACH3
4	ACH4
5	ACH5

Between-Subjects Factors

		Value Label	N
Sex 1=m 2=f	1	male	28
	2	female	77

Descriptive Statistics

	Sex 1=m 2=f	Mean	Std. Deviation	N
Ach, cases 1-20	male	.37374	.16027	28
	female	.44987	.15389	77
	Total	.42957	.15849	105
Ach, cases 21-40	male	.59253	.12985	28
	female	.62548	.12353	77
	Total	.61669	.12547	105
Ach, cases 41-60	male	.37409	.11650	28
	female	.39583	.10308	77
	Total	.39004	.10669	105
Ach, cases 61-80	male	.37305	.12745	28
	female	.36351	.11546	77
	Total	.36606	.11822	105
Ach, cases 81-100	male	.11003	.16522	28
	female	.13495	.13979	77
	Total	.12831	.14659	105

This part of the output (Descriptive Statistics) shows you the sample size, mean, and standard deviation for each cell in the design.

Multivariate Tests[b]

Effect		Value	F	Hypothesis df	Error df	Sig.
ACCURACY	Pillai's Trace	.867	162.842[a]	4.000	100.000	.000
	Wilks' Lambda	.133	162.842[a]	4.000	100.000	.000
	Hotelling's Trace	6.514	162.842[a]	4.000	100.000	.000
	Roy's Largest Root	6.514	162.842[a]	4.000	100.000	.000
ACCURACY * SEX	Pillai's Trace	.046	1.196[a]	4.000	100.000	.317
	Wilks' Lambda	.954	1.196[a]	4.000	100.000	.317
	Hotelling's Trace	.048	1.196[a]	4.000	100.000	.317
	Roy's Largest Root	.048	1.196[a]	4.000	100.000	.317

a. Exact statistic

b.
Design: Intercept+SEX
Within Subjects Design: ACCURACY

Mauchly's Test of Sphericity[b]

Measure: MEASURE_1

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	df	Sig.
ACCURACY	.699	36.334	9	.000

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

Mauchly's Test of Sphericity[b]

Measure: MEASURE_1

Within Subjects Effect	Epsilon[a]		
	Greenhouse-Geisser	Huynh-Feldt	Lower-bound
ACCURACY	.848	.889	.250

Tests the null hypothesis that the error covariance matrix of the orthonormalized transformed dependent variables is proportional to an identity matrix.

a. May be used to adjust the degrees of freedom for the averaged tests of significance. Corrected tests are displayed in the Tests of Within-Subjects Effects table.

b.
Design: Intercept+SEX
Within Subjects Design: ACCURACY

Tests of Within-Subjects Effects

Measure: MEASURE_1

Source		Type III Sum of Squares	df	Mean Square	F	Sig.
ACCURACY	Sphericity Assumed	9.850	4	2.462	182.355	.000
	Greenhouse-Geisser	9.850	3.394	2.902	182.355	.000
	Huynh-Feldt	9.850	3.558	2.769	182.355	.000
	Lower-bound	9.850	1.000	9.850	182.355	.000
ACCURACY * SEX	Sphericity Assumed	7.785E-02	4	1.946E-02	1.441	.219
	Greenhouse-Geisser	7.785E-02	3.394	2.294E-02	1.441	.226
	Huynh-Feldt	7.785E-02	3.558	2.188E-02	1.441	.225
	Lower-bound	7.785E-02	1.000	7.785E-02	1.441	.233
Error(ACCURACY)	Sphericity Assumed	5.563	412	1.350E-02		
	Greenhouse-Geisser	5.563	349.574	1.591E-02		
	Huynh-Feldt	5.563	366.436	1.518E-02		
	Lower-bound	5.563	103.000	5.401E-02		

*This part of the output (Tests of Within-Subjects Effects) provides tests for each within-subjects factor in your design (here there is only one, labeled ACCURACY) and any interactions that include at least one within-subjects factor (there is also one here, labeled ACCURACY * SEX). You get the standard ANOVA summary information, which includes SS, df, MS, F, and p (labeled "Sig.").*

For the main effect of accuracy: F(4, 412) = 182.36, p < .001, revealing a reliable difference across levels of the factor. To determine which levels differ reliably from one another, a post-hoc test needs to be conducted. Unfortunately, SPSS will not compute post-hoc tests for repeated-measures factors, so you'll need to do this by hand (consult any Statistics textbook).

For a simple Tukey test, the information that you'll need is here, so it's an easy calculation. In this case, MSwithin = .01350 (1.350E-02 appears under Mean Square on the Error line); n = 105 (the number of scores, which you can get from the Descriptive Statistics table above); k = 5 (there are five levels of the

factor); and df(for MSerror) = 412 (this is the df value for the Error line). Using a table, you'd see that q = 3.86 (using k = 5, df = infinity (closest value to 412)), which means HSD = .044. Referring back to the Descriptive Statistics table, any levels whose means differ by at least .044 are reliably different from one another at the .05 level.

For the interaction between accuracy and sex: F(4, 412) = 1.44, p = .219, revealing no reliable interaction.

Tests of Within-Subjects Contrasts

Measure: MEASURE_1

Source	ACCURACY	Type III Sum of Squares	df	Mean Square	F	Sig.
ACCURACY	Linear	5.514	1	5.514	272.816	.000
	Quadratic	2.702	1	2.702	204.804	.000
	Cubic	.303	1	.303	28.181	.000
	Order 4	1.331	1	1.331	135.085	.000
ACCURACY * SEX	Linear	4.312E-02	1	4.312E-02	2.133	.147
	Quadratic	2.682E-02	1	2.682E-02	2.033	.157
	Cubic	2.344E-03	1	2.344E-03	.218	.642
	Order 4	5.577E-03	1	5.577E-03	.566	.454
Error(ACCURACY)	Linear	2.082	103	2.021E-02		
	Quadratic	1.359	103	1.319E-02		
	Cubic	1.108	103	1.076E-02		
	Order 4	1.015	103	9.853E-03		

Tests of Between-Subjects Effects

Measure: MEASURE_1

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Intercept	59.084	1	59.084	1793.681	.000
SEX	8.779E-02	1	8.779E-02	2.665	.106
Error	3.393	103	3.294E-02		

This part of the output (Tests of Between-Subjects Effects) provides tests for each between-subjects factor in your design (here there is only one, labeled SEX) and any interactions that involve only between -subjects factors (there (are none here here). You get the standard ANOVA summary information, which includes SS, df, MS, F, and p (labeled "Sig.").

For the main effect of sex: F(1, 103) = 2.67, p = .106, revealing no reliable difference between men and women.