

Repeated Measures Analysis (Mixed Model)

This guide provides instructions on the analysis of repeated measures data using a mixed model (random and fixed effects) with nesting. The term *repeated measures* refers to data with multiple measurements taken on the same subjects, often taken over a period of time.

This example involves six animal subjects randomly selected from two species. The miles traveled by each animal were measured over time. Since this data is in a tall format (stacked), a mixed model analysis is used.

Analysis of Repeated Measures: Mixed Model

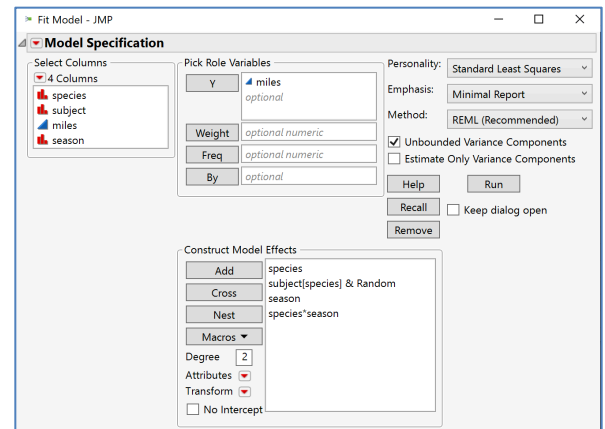
1. From an open JMP® data table, select **Analyze > Fit Model**.
2. Add the response: From **Select Columns**, select a continuous variable (continuous variables have blue triangles), and click **Y**.
3. Add model effects: Select variables and click **Add** (under **Construct Model Effects**). To specify an interaction term, select multiple columns, then click **Cross**.
4. Specify the nesting structure: Here, subject is nested within species. Select 'subject' from **Construct Model Effects**, select 'species' from **Select Columns**, and click **Nest**. (If the subject ID is uniquely valued, skip this step.)
5. Specify random effect(s): Select a model effect, then select **Random** from the red triangle next to **Attributes**. Here, "subject[species]" is specified as a random effect.
6. Accept the defaults (the **REML Method** with **Unbounded Variance Components** selected), and click **Run**.

By default, JMP will display tables of the **Effect Summary**, **Summary of Fit**, **REML Variance Components Estimates**, **Fixed Effect Tests** and more. Additional options are available under the **top red triangle**.

Interpretation:

1. Variance Components Estimates: Show the estimated variances for random effects and the residual error. In this example, the estimated variation between animals is 0.76, or 38% of the total variation.
2. Fixed Effect Tests: Show the F-test results for the fixed effects using the appropriate variance component estimate as an error term in the denominator. Here, species and season are both significant at $\alpha = 0.05$, while the interaction is not.

Example: Animals.jmp (Help > Sample Data Folder)



Response miles

Effect Summary

Summary of Fit

RSquare	0.882157
RSquare Adj	0.8306
Root Mean Square Error	1.111805
Mean of Response	4.458333
Observations (or Sum Wgts)	24

Parameter Estimates

REML Variance Component Estimates

Random Effect	Var Ratio	Component	Std Error	95% Lower	95% Upper	Wald p-Value	Pct of Total
subject[species]	0.6179775	0.7638889	0.7690848	-0.74349	2.2712674	0.3206	38.194
Residual		1.2361111	0.5046402	0.6356236	3.3683119		61.806
Total		2	0.8478339	1.006981	5.720894		100.000

-2 Residual Log Likelihood = 73.655629901

Note: Total is the sum of the positive variance components.

Total including negative estimates = 2

Covariance Matrix of Variance Component Estimates

Iterations

Random Effect Predictions

Fixed Effect Tests

Source	Nparm	DF	DFDen	F Ratio	Prob > F
species	1	1	4	11.8932	0.0261*
season	3	3	12	12.7978	0.0005*
species*season	3	3	12	2.0112	0.1662

Effect Details

See the **Repeated Measures Analysis (ANOVA)** Guide to learn how to analyze repeated measures data using the MANOVA platform.

Visit **Fitting Linear Models > Mixed Models** in **JMP Help** to learn more.