

Mixed Model Analysis

Use a Mixed Model for an ANOVA or regression model with at least one factor specified as a random variable. Additional options for fitting mixed models are available in JMP Pro®. The example below is an unbalanced design involving six people chosen at random to take measurements on three different machines.

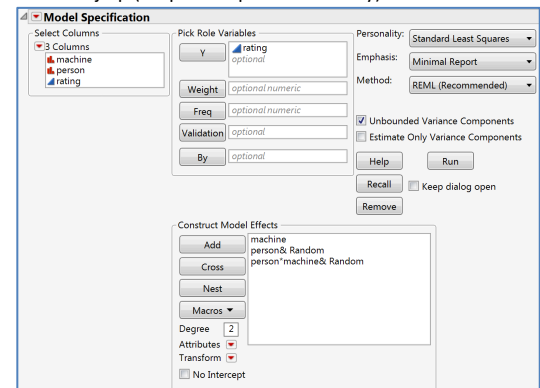
Analysis of Linear Mixed Models

1. From an open JMP data table, select **Analyze > Fit Model**.

JMP PRO In JMP Pro, select the **Mixed** platform from the Personality list to fit mixed models. The remainder of these instructions are for fitting mixed models in JMP.

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 random effect(s): Select a model effect, then select **Random** from the red triangle next to **Attribute**. Here, “person” is specified as a random effect, so the “person*machine” interaction is also a random effect.
5. Accept the defaults (the **REML Method** with **Unbounded Variance Components** selected), and click **Run**.

Machine.jmp (Help > Sample Data Library)



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

Interpretation:

1. Variance Components Estimates: The total estimated variance is 37.56, which can be decomposed into three sources: person (22.46, or 59.8%), person*machine (14.23, or 37.9%) and residual (0.87, or 2.3%).
2. Fixed Effect Tests: The p-value for the fixed effect (machine) is 0.0003. Kenward-Roger F tests are used.

Response rating

Effect Summary

Summary of Fit

RSquare	0.992571
RSquare Adj	0.992209
Root Mean Square Error	0.933203
Mean of Response	59.85
Observations (or Sum Wgts)	44

Parameter Estimates

Random Effect Predictions

REML Variance Component Estimates

Random Effect	Var Ratio	Component	Std Error	95% Lower	95% Upper	Wald p-Value	Pct of Total
person	25.785476	22.455765	17.414105	-11.67525	56.586783	0.1972	59.785
machine*person	16.344588	14.233991	6.5151618	1.4645081	27.003473	0.0289*	37.896
Residual	0.8708667	0.2410664	0.5405379	1.6332462			2.319
Total	37.560625	17.824737	17.698786	126.50166			100.000

-2 LogLikelihood = 184.06872401
Note: Total is the sum of the positive variance components.
Total including negative estimates = 37.560625

Covariance Matrix of Variance Component Estimates

Iterations

Fixed Effect Tests

Source	Nparm	DF	DFDen	F Ratio	Prob > F
machine	2	2	10.11	19.9639	0.0003*

Tips:

- **REML** (restricted maximum likelihood) is the preferred estimation method over **EMS** (Method of Moments). REML estimates are properly shrunk and the standard errors are properly scaled.
- **Unbounded Variance Components** is the default method for estimating the variance components. Unchecking this box will restrict the variance estimates to be non-negative.
- JMP assumes a simple correlation matrix with **compound symmetry** (i.e., correlation is constant).

Notes: For additional details on fitting mixed models in JMP and JMP Pro, search for “Mixed” in the JMP Help or in the book **Fitting Linear Models** (under **Help > Books**).