T-tests, correlations, and ANOVAs can all be described in terms of linear regression equations. Here we describe various general linear models that you may want to use to answer your research question. One example is to use a two-sample t-test to evaluate whether there are differences in EEG power between two groups. The dependent variable in these models are the first-level output variables e.g., the EEG power. The contrasts determine which statistical tests are evaluated. The general linear model is first applied separately at each channel, and the statistical values for each contrast are then corrected for multiple comparisons using cluster-based corrections or threshold-free cluster enhancement.

Good luck, and ask for help if needed,

Rick

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| **Model** | **One sample t-test.** It tests whether the dependent variable has a non-zero mean. It is unlikely you’ll ever use this model. But it is explained here as it is a good starting point. |
| **Equation** |  |
| **Matrix** |  |
| **Means** |  |
| **H0** |  |
| **T-contrast** |  |

|  |  |
| --- | --- |
| **Model** | **Correlation.** It tests whether the dependent variable correlates with a continuous factor. |
| **Equation** |  |
| **Matrix** | \* |
| **Means** |  |
| **H0** |  |
| **T-contrast** |  |

\* Note that the independent variable is demeaned. When the independent variable is z-scored, then will equal the correlation coefficient *r*.

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| **Model** | **Two sample unpaired t-test.** Also known as a 1-way ANOVA with 2 levels. It tests whether group A and B have different mean values of the dependent variable. |
| **Equation** |  |
| **Matrix** |  |
| **Means** |  |
| **H0** | Mean group A is zero |
| **T-contrast** |  |
| **H0** | Mean group B is zero |
| **T-contrast** |  |
| **H0** | Mean group A is equal to mean group B |
| **T-contrast** |  |

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| **Model** | **Paired sample t-test.** Also known as a 1-way repeated measures ANOVA with 2 levels. It tests whether group A and B have different mean values of the dependent variable where each participant has *exactly* two measures. |
| **Equation** | \* |
| **Matrix** |  |
| **Means** |  |
| **H0** | Mean group A is equal to mean group B |
| **T-contrast** |  |

\* Never construct contrasts on

|  |  |
| --- | --- |
| **Model** | **1-way ANOVA (with 3+ levels).** It tests whether group A or B or C or … have different mean values of the dependent variable. |
| **Equation** |  |
| **Matrix** |  |
| **Means** | \* |
| **H0** | All groups have equal mean (main effect) \* |
| **F-contrast** |  |
| **H0** | Mean group A is equal to mean group B |
| **T-contrast** |  |
| **H0** | Mean group A is equal to mean group C |
| **T-contrast** |  |
| **H0** | Mean group B is equal to mean group C |
| **T-contrast** |  |

\* Group A is the reference group

|  |  |
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| **Model** | **2-way ANOVA (2 factors with 2+ levels).** It tests whether any group in a factor have different mean values of the dependent variable, and whether the two factors interact. This example has two factors, one with three levels (A, B, and C), and another with two levels (X and Y). Levels A and X are the reference groups for the factors, respectively. Following the intercept, there are two regressors for the first factor and one for the second factor (# levels – 1). The interaction terms are constructed using simple element-wise multiplication between each pair columns of each factor (except the intercept). |
| **Equation** |  |
| **Matrix** |  |
| **Means** |  |
| **H0** | Main effect of first factor with levels A, B, and C \* |
| **F-contrast** |  |
| **H0** | Main effect of second factor with levels X and Y \* |
| **F-contrast** |  |
| **H0** | Mean group A is equal to mean group B |
| **T-contrast** |  |
| **H0** | Mean group B is equal to mean group C |
| **T-contrast** |  |
| **H0** | Mean group AX is equal to mean group AY |
| **T-contrast** |  |

\* Groups A and X are the reference groups of the two factors