Factor Correction

Factor Correction can be used to remove multiplicative between-session variation in experiments in which a number of measurement sessions were needed to collect all data. These replicate measurement sessions very often show similar proportional differences between experimental conditions, but different absolute values, even though the measurements were presumably carried out under identical circumstances. Although statistical programs enable the analysis of condition effects despite this replication error, this approach is hardly ever used for this purpose. On the contrary, most researchers deal with such between-session variation by normalisation or standardisation of the data. In normalisation all values in a session are divided by the observed value of the 'control' condition, whereas in standardisation, the sessions' means and standard deviations are used to correct the data. Normalisation, however, adds variation because the control value is not without error, while standardisation is biased if the data set is incomplete. In most cases, between-session variation is multiplicative and can, therefore, be removed by division of the data in each session with a session-specific correction factor. Assuming one level of multiplicative between-session error, unbiased session factors can be calculated from all available data through the generation of a between-session ratio matrix. Alternatively, these factors can be estimated with a maximum likelihood approach. The effectiveness of this correction method, dubbed "factor correction", is demonstrated with examples from the field of molecular biology and retrovirology. Especially when not all conditions are included in every measurement session, factor correction results in smaller residual error than normalisation and standardisation and therefore allows the detection of smaller treatment differences. See: Ruijter et al. Retrovirology 3:2, 2006.

FAQs

- **How do I distinguish between 'session' and 'condition'?**
  The session is the variable that causes the variation that you want to remove. In most cases it is the measurement identified by 'date' or 'run'. The condition is the variable or combination of variables of which you want to preserve the effects.
- **What is the difference between the Ratio and the Maximum Likelyhood method?**
  The difference between these two methods is the way in which the correction factors per session are calculated. In most cases, the factors only differ a few percent and the biological result of your experiment will not be affected by the choice of the method.
- **Can I correct a data set with positive and negative values?**
  The Ratio method only accepts positive values. Negative values are not allowed. The maximum likelihood estimation accepts negative values but the results may not be what you want when a condition contains positive as well as negative values.
- **Can the data set contain zero's?**
  Yes, but in the calculation of the session factors the value zero is ignored. However, the session factors are applied to zeros, which results of course in the corrected value of zero.
- **Can I correct a data set without overlap between sessions?**
  No, there has to be at least one condition that is shared by each pair of sessions. When this is not the case, calculations wil not be performed because the resulting factors and condition means are completely useless. Note that the shared condition can be different for each pair of sessions.

References

- [Ruijter JM, Thygesen HH, Schoneveld JLM, Das A, Berkhout B, and Lamers WH.](#) Factor

correction as a tool to eliminate between-session variation in replicate experiments: application to molecular biology and retrovirology. Retrovirology 3:2, 2006.

Version History

Factor Correction version 2020.0. Released January 2020.

- Small modifications to the layout of the user interface to make all buttons visible in Windows 10.
- This change does not affect the results of the analysis.

Factor Correction version 2016.1. Released August 2016.

- In the previous versions of Factor a user selection that was set in parallel to a "split variable" correction did not appear in the correction history. This was corrected in this version.
- This change does not affect the results of the analysis becasue the user selection was already correctly applied in combination with the split correction.

Factor Correction version 2015.2. Released April 2015.

- In this version of Factor some small problems in the previous version were repaired. In a "split variable" correction, the correction factors were applied to all valid cases, not just to the included cases. Moreover, the selection because of the split was not added to the correction history.
- This change does not affect the results of the analysis.

Factor Correction version 2015.1. Released January 2015.

- This version of Factor allows the removal of session variation within each level of a specified variable. To be used when different sets of sessions are present for each level of a third variable, i.e. nests of mice for each developmental stage.
- This change does not affect the results of the analysis.

Factor Correction version 2014.1. Released September 2014.

- Added the option to use a variable with (decimal) points in its values as condition variable. The user has to be sure that there is only a limited number of possible values.
- The warning that empty sessions are present is only given once when more such sessions are present.
- These changes do not affect the results of the analysis.

Factor Correction version 10.5. Released September 2012.

- Corrected the wrong display of the analysis date in Excel which could occur before the 13th of the month.
- Changed the annotation in the history grid to indicate the use of 'apply also to'.
- These changes do not affect the results of the analysis.

Factor Correction version 10.4. Released January 2012.

- Removed 'decimal separator' error that could occur when tolerance field was read in Maximum Likelihood approach.

Factor Correction version 10.3. Released April 2011.

- Improved handling of different decimal separators in different Regional Settings of Windows.

Factor Correction version 10.2. Released March 2011.

- Version information is written to Windows Registry and version number is checked at start-up.

Factor Correction version 10.1. Released February 2009.

- Handling of scientific annotation in input variables.

Factor Correction version 10.0. Released April 2008.

- Selection of export variables and cases.

Factor Correction version 9.0. Released January 2007.

- Calculation of correction factors with Ratio or Maximum Likelihood methods.
- Application of correction factors to another variable.
- Selection of cases to be used for calculation of the correction factors.