

cofad: An R package and shiny app for contrast analysis

Johannes Titz¹ and Markus Burkhardt¹

¹ Department of Psychology, TU Chemnitz, Germany

Summary

Cofad is an R package and shiny app for conducting COntラスト analysis in FActorial Designs like ANOVAs. Despite many advantages, contrast analysis is unknown to most researchers. For instance, even if researchers have a specific hypothesis for group means in an experimental design, they usually run an omnibus test or multiple post-hoc tests. The first approach reduces power while the second increases the type I error because of multiple testing. Contrast analysis is always the better alternative as it provides a single specific test with high power. Although it is possible to use contrasts in most statistical software tools, these are ad-hoc solutions that lack a consistent framework. In contrast, cofad provides a single function for between, within and mixed designs in the tradition and language of Rosenthal & Rosnow (1985), Rosenthal et al. (1999) and Sedlmeier & Renkewitz (2018). In addition, a graphical user interface in the form of a shiny app can either be used locally or online at <https://cofad.titz.science>. Practical research examples of using cofad can be found in a german textbook on data analysis with R (Sedlmeier & Burkhardt, 2021).

Alternatives

The R packages lsmeans (Lenth, 2016) and multcomp (Hothorn et al., 2008) provide contrast coding from a multiple comparison perspective. These tools are used to test typical (multiple) contrasts such as *all possible pairs* or *treatment versus control*. Although it is possible to use a more specific contrast it involves multiple steps and is less convenient than in cofad. For instance, the order of contrasts has to strictly adhere to the order of the independent variable, which can quickly lead to mistakes that are difficult to spot. Furthermore, typical effect sizes in contrast analysis such as $r_{\text{effectsize}}$ are not reported. Cofad is easier to use because the model and the contrast can be set in a single step. Furthermore, errors in specifying contrasts are unlikely because a named vector has to be provided with all conditions of the independent variable.

SPSS (IBM, 2020) offers a function for planned contrasts in an ANOVA. But to our knowledge it cannot handle within designs or mixed designs. A minor annoyance is that adding contrasts involves many steps and the interface does not show which contrasts are mapped to which group. Again, cofad is more intuitive to use and prevents input errors.

Acknowledgments

We want to thank Thomas Schäfer and Isabell Winkler for testing cofad and giving helpful feedback.

References

Hothorn, T., Bretz, F., & Westfall, P. (2008). Simultaneous inference in general parametric models. *Biometrical Journal*, 50(3), 346–363. <https://doi.org/b5f2gc>

DOI: [DOIunavailable](#)

Software

- [Review](#) ↗
- [Repository](#) ↗
- [Archive](#) ↗

Editor: [Pending Editor](#) ↗

Reviewers:

- [@Pending Reviewers](#)

Submitted: N/A

Published: N/A

License

Authors of papers retain copyright and release the work under a Creative Commons Attribution 4.0 International License ([CC BY 4.0](#)).

- IBM. (2020). *IBM SPSS Statistics for Windows, Version 27.0*.
- Lenth, R. V. (2016). Least-squares means: The R package lsmeans. *Journal of Statistical Software*, 69(1), 1–33. <https://doi.org/gdz7q2>
- Rosenthal, R., & Rosnow, R. L. (1985). *Contrast analysis: Focused comparisons in the analysis of variance*. Cambridge University Press.
- Rosenthal, R., Rosnow, R. L., & Rubin, D. B. (1999). *Contrasts and effect sizes in behavioral research: A correlational approach*. Cambridge University Press. <https://doi.org/10.1017/CBO9780511804403>
- Sedlmeier, P., & Burkhardt, M. (2021). *Datenanalyse mit R: Beschreiben, Explorieren, Schätzen und Testen*. Pearson Studium. ISBN: [978-3-86894-412-9](#)
- Sedlmeier, P., & Renkewitz, F. (2018). *Forschungsmethoden und Statistik für Psychologen und Sozialwissenschaftler* (3rd ed.). Pearson Studium. ISBN: [978-3-86894-321-4](#)