

# Package: cofad (via r-universe)

September 4, 2024

**Type** Package

**Title** Contrast Analyses for Factorial Designs

**Version** 0.3.9000

**Description** Contrast analysis for factorial designs provides an alternative to the traditional ANOVA approach, offering the distinct advantage of testing targeted hypotheses. The foundation of this package is primarily rooted in the works of Rosenthal, Rosnow, and Rubin (2000, ISBN: 978-0521659802) as well as Sedlmeier and Renkewitz (2018, ISBN: 978-3868943214).

**License** LGPL (>= 3)

**URL** <https://github.com/johannes-titz/cofad>

**Depends** R (>= 3.1.0)

**Imports** dplyr, Hmisc, magrittr, readr, rhandsontable, rlang, shiny, shinydashboard, shinyjs, stringr, tibble, utils

**Suggests** rmarkdown, shinytest2, testthat (>= 3.0.0)

**Encoding** UTF-8

**LazyData** true

**RoxygenNote** 7.3.2

**Repository** <https://johannes-titz.r-universe.dev>

**RemoteUrl** <https://github.com/johannes-titz/cofad>

**RemoteRef** HEAD

**RemoteSha** b3b90dbb1f99aeba1f39199e0cfa3ca163bf6115

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akan *Data from Akan et al. (2018), experiment 2B*

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### Description

Data contains information from a within-subjects experiment with N = 90 participants. The goal of the experiment was to investigate the benefits of retrieval practice on memory performance. For the entire dataset and analysis scripts see: <https://osf.io/bqr5f/>. The data was licensed under CC-BY 4.0 Melisa Akan, Aaron Benjamin.

### Usage

```
data(akan)
```

### Format

a data frame with 270 rows and 3 variables:

**subject** subject id

**condition** experimental condition (test, restudy, control)

**recalled** dependent variable

**Source**

Akan, M., Stanley, S. E., & Benjamin, A. S. (2018). Testing enhances memory for context. *Journal of Memory and Language*, 103, 19–27. doi:10.1016/j.jml.2018.07.003

---

calc_contrast	<i>Calculate contrast analysis for factorial designs</i>
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---

**Description**

Calculate contrast analysis for factorial designs

**Usage**

```
calc_contrast(
  dv,
  between = NULL,
  lambda_between = NULL,
  within = NULL,
  lambda_within = NULL,
  ID = NULL,
  id = NULL,
  data = NULL
)
```

**Arguments**

dv	dependent variable. Values must be numeric.
between	independent variable that divides the data into independent groups. Vector must be a factor.
lambda_between	contrast weights must be a named numeric. Names must match the levels of between. If lambda_between does not sum up to zero, this will be done automatically.
within	independent variable which divides the data into dependent groups. This must be a factor.
lambda_within	contrast must be a named numeric. Names must match the levels of between. If lambda_within does not sum up to zero, this will be done automatically.
ID	deprecated, use id instead
id	identifier for cases or subjects is needed for within- and mixed contrast analysis.
data	optional argument for the data.frame containing dv and groups.

**Details**

For multi-factorial designs, the lambda weights of the factors must be connected.

Note that cofad returns one-sided p-values for t-tests.

**Value**

an object of type `cofad_bw` or `cofad_wi` or `cofad_mx`, including p-value, F-value, contrast weights, different effect sizes. Call `summary` on this object to get a nice overview of all relevant statistics. Call `print` to get a short text that can be used for a report.

**References**

Rosenthal, R., Rosnow, R.L., & Rubin, D.B. (2000). *Contrasts and effect sizes in behavioral research: A correlational approach*. New York: Cambridge University Press.

**Examples**

```
# Example for between-subjects design Table 3.1 from
# Rosenthal, Rosnow and Rubin (2001)

data(rosenthal_tbl31)
contr_bw <- calc_contrast(
  dv = dv,
  between = between,
  lambda_between = c("A" = -3, "B" = -1, "C" = 1, "D" = 3),
  data = rosenthal_tbl31)
contr_bw
summary(contr_bw)

# Example for within-subjects design Calculation 16.6 from
# Sedlmeier and Renkewitz (2018, p. 537)

data(sedlmeier_p537)
contr_wi <- calc_contrast(
  dv = reading_test,
  within = music,
  id = participant,
  lambda_within = c(
    "without music" = 1.25,
    "white noise" = 0.25,
    "classic" = -0.75,
    "jazz" = -0.75
  ),
  data = sedlmeier_p537
)
contr_wi
summary(contr_wi, ci = .90)

# Example for mixed-design Table 5.3 from
# Rosenthal, Rosnow and Rubin (2001)

data(rosenthal_tbl53)

contr_mx <- calc_contrast(dv = dv, between = between,
  lambda_between = c("age8" = -1, "age10" = 0, "age12" = 1),
  within = within,
  lambda_within = c("1" = -3, "2" = -1, "3" = 1, "4" = 3),
```

```

      id = id, data = rosenthal_tbl153
    )
  contr_mx
  summary(contr_mx)

```

---

calc\_contrast\_aggregated

*Calculate between contrast analysis from aggregated data (means, sds and ns)*

---

### Description

Calculate between contrast analysis from aggregated data (means, sds and ns)

### Usage

```
calc_contrast_aggregated(means, sds, ns, between, lambda_between, data)
```

### Arguments

means	numeric vector of mean values for every condition
sds	numeric vector of standard deviation values for every condition
ns	numeric vector of sample size values for every condition
between	factor for the independent variable that divides the data into independent groups
lambda_between	numeric vector for contrast weights. Names must match the levels of between. If lambda_between does not sum up to zero, this will be done automatically (centering).
data	optional argument for the data . frame containing all variables except for lambda_between

### Value

an object of type cofad\_bw, including p-value, F-value, contrast weights, different effect sizes

### References

Rosenthal, R., Rosnow, R.L., & Rubin, D.B. (2000). Contrasts and effect sizes in behavioral research: A correlational approach. New York: Cambridge University Press.

### Examples

```

library(dplyr)
furr_agg <- furr_p4 %>%
  group_by(major) %>%
  summarize(mean = mean(empathy), sd = sd(empathy), n = n())
lambdas = c("psychology" = 1, "education" = -1, "business" = 0,
            "chemistry" = 0)
calc_contrast_aggregated(mean, sd, n, major, lambdas, furr_agg)

```

---

calc_r_alerting	<i>Calculate r_alerting from r_contrast and r_effectsize</i>
-----------------	--

---

**Description**

Convenience function to transform effect sizes in contrast analyses.

**Usage**

```
calc_r_alerting(r_contrast, r_effectsize)
```

**Arguments**

r_contrast	what it says
r_effectsize	what it says

---

calc_r_alerting_from_f	<i>Calculate r_alerting from F-values</i>
------------------------	---

---

**Description**

Convenience function to calculate effect sizes in contrast analyses.

**Usage**

```
calc_r_alerting_from_f(f_contrast, f_between, df_between)
```

**Arguments**

f_contrast	F value from contrast analysis
f_between	F value from ANOVA (one between variable!)
df_between	degrees of freedom of ANOVA

---

calc_r_contrast	<i>Calculate r_contrast from r_alerting and r_effectsize</i>
-----------------	--

---

**Description**

Convenience function to transform effect sizes in contrast analyses.

**Usage**

```
calc_r_contrast(r_alerting, r_effectsize)
```

**Arguments**

r_alerting	what it says
r_effectsize	what it says

---

calc_r_effectsize	<i>Calculate r_effectsize from r_contrast and r_alerting</i>
-------------------	--

---

**Description**

Convenience function to transform effect sizes in contrast analyses.

**Usage**

```
calc_r_effectsize(r_alerting, r_contrast)
```

**Arguments**

r_alerting	what it says
r_contrast	what it says

---

furr\_p4

*Empathy data set by Furr (2004)*

---

**Description**

fictitious data set on empathy ratings of students from different majors

**Usage**

```
data(furr_p4)
```

**Format**

a data frame with 20 rows and 2 columns

**empathy** Empathy rating

**major** major of student

**Source**

Furr, R. M. (2004). Interpreting effect sizes in contrast analysis. *Understanding Statistics*, 3, 1–25.  
[https://doi.org/10.1207/s15328031us0301\\_1](https://doi.org/10.1207/s15328031us0301_1)

---

haans\_within1by4

*Haans within data example*

---

**Description**

Fictitious data set from Haans, A. (2018). Contrast Analysis: A Tutorial. <https://doi.org/10.7275/7DEY-ZD62>

**Usage**

```
data(haans_within1by4)
```

**Format**

a data frame with 20 rows and 3 variables:

**person** person id

**name** group name (sitting row 1 to 4)

**value** dv, final exam grade



---

print.cofad\_bw            *Output of between-subject design contrast analysis*

---

**Description**

Output of between-subject design contrast analysis

**Usage**

```
## S3 method for class 'cofad_bw'  
print(x, ...)
```

**Arguments**

x	output of calc_contrast
...	further arguments

**Value**

Displays the significance of the contrast analysis. The contrast weights, the corresponding group and an effectsize are given.

---

print.cofad\_mx            *Output of a mixed design contrast analysis*

---

**Description**

Output of a mixed design contrast analysis

**Usage**

```
## S3 method for class 'cofad_mx'  
print(x, ...)
```

**Arguments**

x	output of calc_contrast
...	further arguments

**Value**

Displays the significance of the contrast analysis. The contrastweights, the corresponding group and an effectsize are given.

---

```
print.cofad_wi      Output of a within subject design contrast analysis
```

---

**Description**

Output of a within subject design contrast analysis

**Usage**

```
## S3 method for class 'cofad_wi'
print(x, ...)
```

**Arguments**

```
x          output of calc_contrast
...        further arguments
```

**Value**

Displays the significance of the contrast analysis. The contrastweights, the corresponding group and an effectsizes are given.

---

```
rosenthal_chap5_q2  Complexity data set by Rosenthal and Rosnow (2000)
```

---

**Description**

Exercise 2 from Chapter 5 (table on p. 147) in Rosenthal and Rosnow (2000)

**Usage**

```
data(rosenthal_chap5_q2)
```

**Format**

a data frame with 12 rows and 4 columns

**dv** dependent variable: rating of degree of complexity of social interaction from a series of clips

**id** unique identifier of participant

**within** within variable: complexity of interaction (low, medium high)

**between** between variable: cognitive complexity of participant (high or low)

**Source**

Rosenthal, R., Rosnow, R. L., & Rubin, D. B. (2000). *Contrasts and Effect Sizes in Behavioral Research: A Correlational Approach*. Cambridge University Press.

---

rosenthal\_p141      *Data set by Rosenthal and Rosnow (2000)*

---

**Description**

Fictitious example corresponding to aggregated data set on p. 141 in Rosenthal and Rosnow (2000)

**Usage**

```
data(rosenthal_p141)
```

**Format**

a data frame with 12 rows and 4 columns

**id** unique identifier of participant

**dv** dependent variable

**within** within variable

**between** between variable

**Source**

Rosenthal, R., Rosnow, R. L., & Rubin, D. B. (2000). *Contrasts and Effect Sizes in Behavioral Research: A Correlational Approach*. Cambridge University Press.

---

rosenthal\_tbl31      *Data set by Rosenthal and Rosnow (2000)*

---

**Description**

Table 3.1 in Rosenthal and Rosnow (2000) on p. 38.

**Usage**

```
data(rosenthal_tbl31)
```

**Format**

a data frame with 20 rows and 2 columns

**dv** dependent variable

**between** group (A, B, C, D))

**Source**

Rosenthal, R., Rosnow, R. L., & Rubin, D. B. (2000). *Contrasts and Effect Sizes in Behavioral Research: A Correlational Approach*. Cambridge University Press.

---

rosenthal\_tb153      *Children data set by Rosenthal and Rosnow (2000)*

---

**Description**

Table 5.3 in Rosenthal and Rosnow (2000) on p. 129.

**Usage**

```
data(rosenthal_tb153)
```

**Format**

a data frame with 36 rows and 4 columns

**dv** dependent variable

**between** age group (8, 10, 12 years)

**id** unique identifier for child

**within** measurement (1, 2, 3, 4)

**Source**

Rosenthal, R., Rosnow, R. L., & Rubin, D. B. (2000). *Contrasts and Effect Sizes in Behavioral Research: A Correlational Approach*. Cambridge University Press.

---

rosenthal\_tb159      *Therapy data set by Rosenthal and Rosnow (2000)*

---

**Description**

Table 5.9 in Rosenthal and Rosnow (2000)

**Usage**

```
data(rosenthal_tb159)
```

**Format**

a data frame with 12 rows and 4 columns

**id** unique identifier

**dv** dependent variable

**med** within variable: medication (treatment or placebo)

**pt** between variable: psychotherapy (treatment or placebo)

**Source**

Rosenthal, R., Rosnow, R. L., & Rubin, D. B. (2000). *Contrasts and Effect Sizes in Behavioral Research: A Correlational Approach*. Cambridge University Press.

---

rosenthal_tbl68	<i>Data set by Rosenthal and Rosnow (2000)</i>
-----------------	--

---

**Description**

Fictitious example of children ability, Table 6.8 in Rosenthal and Rosnow (2000)

**Usage**

```
data(rosenthal_tbl68)
```

**Format**

a data frame with 8 rows and 4 columns

**id** unique identifier of participant

**dv** dependent variable

**within** within variable

**between** between variable

**Source**

Rosenthal, R., Rosnow, R. L., & Rubin, D. B. (2000). *Contrasts and Effect Sizes in Behavioral Research: A Correlational Approach*. Cambridge University Press.

---

run_app	<i>Starts the mimosa shiny app</i>
---------	------------------------------------

---

**Description**

Starts the mimosa shiny app

**Usage**

```
run_app()
```

---

schwoebel

*Data from Schwoebel et al. (2018)*

---

**Description**

For the entire dataset and analysis scripts see:

**Usage**

```
data(schwoebel)
```

**Format**

a data frame with 64 rows and 2 variables:

**condition** experimental condition (massed-same, massed-different, spaced-same, spaced-different)

**percent\_recalled** dependent variable

**Source**

Schwoebel, J., Depperman, A. K., & Scott, J. L. (2018). Distinct episodic contexts enhance retrieval-based learning. *Memory*, 26(9), 1291–1296. doi:10.1080/09658211.2018.1464190

---

sedlmeier\_p525

*Problem solving data set by Sedlmeier & Renkewitz (2018)*

---

**Description**

Example 16.2, table 16.1 in Sedlmeier & Renkewitz (2018). Fictitious data set with 15 boys divided into three groups (no training, boys-specific material, girls-specific training material). The DV is the number of solved problem (similar to the training).

**Usage**

```
data(sedlmeier_p525)
```

**Format**

a data frame with 15 rows and 3 columns

**lsg** dv, number of solved exercises

**between** group, KT=no training, JT=boys-specific, MT=girls-specific

**lambda** lambdas used for this example

**Source**

Sedlmeier, P., & Renkewitz, F. (2018). *Forschungsmethoden und Statistik für Psychologen und Sozialwissenschaftler* (3rd ed.). Pearson Studium.

---

sedlmeier\_p537      *Music data set by Sedlmeier & Renkewitz (2018)*

---

### Description

Example 16.6, table 16.5 in Sedlmeier & Renkewitz (2018). Fictitious data set with 8 participants that listened to no music, white noise, classical music, and jazz music (within). The DV is a reading test.

### Usage

```
data(sedlmeier_p537)
```

### Format

a data frame with 32 rows and 3 columns

**reading\_test** dependent variable

**participant** unique id

**music** within variable

### Source

Sedlmeier, P., & Renkewitz, F. (2018). *Forschungsmethoden und Statistik für Psychologen und Sozialwissenschaftler* (3rd ed.). Pearson Studium.

---

summary.cofad\_bw      *Summary of between subject design contrast analysis*

---

### Description

Summary of between subject design contrast analysis

### Usage

```
## S3 method for class 'cofad_bw'
summary(object, ...)
```

### Arguments

object                  output of calc\_contrast  
 ...                      further arguments

### Value

Displays type of contrast analysis, lambdas, t-table, ANOVA table and typical effect sizes. If you assign this to a variable, it will be a list with the elements Lambdas, tTable, FTable, Effects.

---

summary.cofad\_mx      *Summary of a mixed design contrast analysis*

---

**Description**

Summary of a mixed design contrast analysis

**Usage**

```
## S3 method for class 'cofad_mx'
summary(object, ...)
```

**Arguments**

object	output of calc_contrast
...	further arguments

**Value**

Displays type of contrast analysis, lambdas, t-table, ANOVA table and typical effect sizes. If you assign this to a variable, it will be a list with the elements Lambdas, tTable, FTable, Effects.

---

summary.cofad\_wi      *Summary of within subject design contrast analysis*

---

**Description**

Summary of within subject design contrast analysis

**Usage**

```
## S3 method for class 'cofad_wi'
summary(object, ci = 0.95, ...)
```

**Arguments**

object	output of calc_contrast
ci	confidence intervall for composite Score (L-Values)
...	further arguments

**Value**

Displays type of contrast analysis, lambdas, t-table and typical effect sizes. If you assign this to a variable, it will be a list with the elements Lambdas, tTable, Effects.

---

`testing_effect`*Testing Effect data*

---

**Description**

This dataset originates from a study conducted as part of a research seminar in the Psychology B.Sc. program of the University of Cologne. The study participants learned a list of 20 non-associated word pairs. Each half of the word pair was associated with one of two sources (imagining the word pair in the sky or underwater). The final memory test (cued recall) was conducted two days later. Cued recall means that one word of the word pair was presented, and the participant had to recall the other word. The participants were randomly assigned into one of three between-participant conditions: restudy, source test, item test.

**Usage**

```
data(testing_effect)
```

**Format**

a data frame with 60 rows and 3 variables:

**subject** the participant's id

**condition** the between-participant condition

**recalled** the number of words recalled in the cued-recall test

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