

# Package: qcapower (via r-universe)

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**Type** Package

**Title** Estimate Power and Required Sample Size in QCA

**Version** 0.1.0

**Imports** ggplot2, ggforce, devtools, stats

**Depends** R (>= 2.10)

**Description** Researchers working with Qualitative Comparative Analysis (QCA) can use the package to estimate power of a sufficient term using permutation tests. A term can be anything: A condition, conjunction or disjunction of any combination of these. The package further allows users to plot the estimation results and to estimate the number of cases required to achieve a certain level of power, given a prespecified null and alternative hypothesis. Reference for the article introducing power estimation for QCA is: Rohlfing, Ingo (2018) <[doi:10.1017/pan.2017.30](https://doi.org/10.1017/pan.2017.30)> (ungated version: <[doi:10.17605/OSF.IO/PC4DF](https://doi.org/10.17605/OSF.IO/PC4DF)>).

**License** GPL-3

**Encoding** UTF-8

**LazyData** true

**RoxygenNote** 7.0.2

**Suggests** knitr, rmarkdown

**VignetteBuilder** knitr

**URL** <https://github.com/ingorohlfing/qcapower>

**BugReports** <https://github.com/ingorohlfing/qcapower>

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

**RemoteUrl** <https://github.com/ingorohlfing/qcapower>

**RemoteRef** HEAD

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qcapower	<i>qcapower returns a power estimate with regard to the consistency of a term, given information about the required parameters</i>
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## Description

qcapower allows you to estimate power for a term. Probability is the probability of rejecting the null hypothesis that no set relation is in place when it is in place, in fact. A term can be a single condition, a conjunction, or a disjunction of any combination of the two.

## Usage

```
qcapower(
  cases,
  null_hypo,
  alt_hypo,
  sims = 1000,
  perms = 10000,
  alpha = 0.05,
  cons_threshold = 0.01,
  set_seed = 135
)
```

## Arguments

cases	Number of cases. In fuzzy-set QCA, equal to total number of cases in the analysis
null_hypo	Null hypothesis ( <i>H0</i> ). Consistency value separating consistent from inconsistent terms. It is the highest possible consistency value that would let you conclude that no set relation is given.
alt_hypo	Alternative hypothesis ( <i>H1</i> ). Expected, actual consistency value of term.
sims	Number of simulations for calculating power
perms	Number of permutations of hypothetical dataset per simulation run
alpha	Level of alpha at which statistical significance of H0 is tested

cons\_threshold Degree of tolerance in generating hypothetical data with consistency equaling alt\_hypo (see vignette)

set\_seed Parameter for achieving reproducibility of estimate

### Value

A dataframe with rows equaling the number of sims. power is the power estimate and is identical for each rows. powercum is the running power estimate up to this row. quant is the 5%-quantile of the permuted distributions. See the vignette for more information.

### See Also

[qp\\_quant\\_plot](#) and [qp\\_run\\_plot](#)

### Examples

```
power_data <- qcaper(cases = 20, null_hypo = 0.8, alt_hypo = 0.95, sims = 10, perms = 1000)
head(power_data)
```

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qp_cases	<i>Calculate the number of cases for a particular case target based on simulated data</i>
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### Description

qp\_cases calculates the number of cases needed for a particular power level. It is based on the presimulated data using qcaper. See the vignette for more details.

### Usage

```
qp_cases(power_target, null_hypo, alt_hypo)
```

### Arguments

power\_target Desired level of power

null\_hypo Null hypothesis ( $H_0$ ). Consistency value separating consistent from inconsistent terms.

alt\_hypo Alternative hypothesis ( $H_1$ ). Expected, actual consistency value of term.

### Value

An integer showing how many cases are needed to achieve the target level of power.

### See Also

[qp\\_cases\\_brute](#)

**Examples**

```
qp_cases(0.1, null_hypo = 0.8, alt_hypo = 1)
```

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qp_cases_brute	<i>Calculate the number of cases for a particular case target with iterative simulations (brute force)</i>
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**Description**

qp\_cases\_brute calculates the number of cases needed for a particular power level. The function starts with the number of cases given by start\_value and iteratively simulates power and adjusts the number of cases until the power\_target is met or the max\_value has been reached. Running the function can take a lot of time. Use [qp\\_cases](#) to

**Usage**

```
qp_cases_brute(
  power_target,
  start_value = 2,
  max_value = 100,
  progress = TRUE,
  ...
)
```

**Arguments**

power_target	Power level target
start_value	Default number of cases for initial search
max_value	Default maximum number of cases for search
progress	Show progress of calculation (default TRUE)
...	qcapower parameters – see <a href="#">qcapower</a>

**Value**

An integer showing how many cases are needed to achieve the target level of power.

**See Also**

[qp\\_cases\\_brute](#)

### Examples

```
## Not run:
qp_cases_brute(power_target = 0.9, null_hypo = 0.80, alt_hypo = 1)

qp_cases_brute(power_target = 0.9, null_hypo = 0.80, alt_hypo = 1, start_value = 20,
               max_value = 50, perms = 500)

## End(Not run)
```

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qp\_quant\_plot

*Sina plot of 5 distributions*

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### Description

Depending on the number of cases, the permuted distributions of consistency values can differ narrowly or widely in terms of their location on the spectrum and their shape.

### Usage

```
qp_quant_plot(power_est, title = FALSE)
```

### Arguments

power_est	Dataframe containing simulation results (see <a href="#">qcapower</a> )
title	Option for adding title to plot (default FALSE)

### Details

Creates a sina plot with ggforce

### Value

A sina plot using the cases to visualize the density distribution ('gg' object).

### Examples

```
sim_data <- qp_sina_data
qp_quant_plot(sim_data)
```

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qp_run_plot	<i>Plot of power estimate against the number of simulations</i>
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### Description

qp\_run\_plot allows you to plot the running power estimate to determine whether sims is sufficiently large to derive a reliable estimate

### Usage

```
qp_run_plot(power_est, title = FALSE)
```

### Arguments

power_est	Dataframe containing the simulation results (see <a href="#">qcapower</a> )
title	Option for adding title to plot (default FALSE)

### Details

Creates a plot with ggplot2

### Value

A line plot ('gg' object).

### Examples

```
power_data <- qcapower(cases = 20, null_hypo = 0.8, alt_hypo = 0.95, sims = 10, perms = 1000)
qp_run_plot(power_data)

# Using data with 10000 estimates
data(qp_sina_data)
qp_run_plot(qp_sina_data)
```

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qp_sim_power	<i>Data simulated power estimates</i>
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### Description

A dataset containing power simulations for different number of cases and different values for null- and alternative hypothesis

### Usage

```
qp_sim_power
```

**Format**

A dataframe with simulation parameters and calculated power

**Details**

**cases** number of cases  
**null\_hypo** null hypothesis (H0)  
**alt\_hypo** alternative hypothesis  
**sims** number of simulations  
**perms** number of permutations  
**perms** calculate power

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qp\_sina\_data

*Data simulated power estimates for plotting of 5%-quantiles*

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**Description**

A dataset containing the estimated 5%-quantiles from a power simulation with 1000 simulations each with 10000 permutations. The value for the alternative hypothesis was set to 1.

**Usage**

qp\_sina\_data

**Format**

A dataframe with 1000 rows and 6 variables:

**Details**

**power** power estimate over 1000 simulations  
**powercum** running power estimate for ith simulation  
**null\_hypo** null hypothesis (H0), set to 0.8 (irrelevant here)  
**alt\_hypo** alternative hypothesis (H1), set to 1  
**cases** number of cases, set to 10  
**quant** estimated 5%-quantiles per simulations

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