RKWard –

*a graphical user interface and integrated development environment for statistical analysis with R*

**KölnR**

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*microsoft, cologne – 26.II.2016*
RKWard | in another life

GUIs for R
RKWard
dialogs
console/editor
data
plots
packages
configuration
extendable
plugin concept
rkwarddev
feedback
thx
RKWard | (some of) my R packages

➤ koRpus
text analysis, POS tagging, readability

➤ klausuR
multiple choice test evaluation

➤ roxyPackage
R package for packaging R packages

➤ XiMpLe
XML parser and generator

➤ rkwarddev
RKWard plugin generator

➤ iRcotofun
a jeopardy game in R ;o)
GUIs for R

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JSS special volume 49: »graphical user interfaces for R«

1. Introduction

Nowadays, graphical user interfaces (GUIs) are the most common way of interacting with a computer or other electronic device. Whenever they are arguably not the best way of performing every conceivable job, its dominance has reached the principal operating system, application domains, and tasks. Measured in purely statistical terms, the triumph of this style of interaction is unquestionable and it seems clear that it will remain very popular in the foreseeable future.

However, regarding the discipline of statistics, this supremacy does not seem so dramatically clear, as many of the people working in this field seem to favor using a typed language via a command line interface (CLI) in much more productive, accurate and reproducible way of performing their tasks than a GUI. Actually, we are positive that they are right, because via a command line interface (CLI) is a much more productive, accurate and reproducible way of performing every conceivable job, its dominance has reached the principal operating system, application domains, and tasks. Measured it in purely statistical terms, the triumph of this style of interaction is unquestionable and it seems clear that it will remain very popular in the foreseeable future.

Since R was first launched, it has managed to gain the support of an ever-increasing percentage of academic and professional statisticians. However, the spread of its use among novice and occasional users of statistics has not progressed at the same pace, which can be attributed partially to the lack of a graphical user interface (GUI). Nevertheless, this situation has changed in the last years and there is currently several projects that aim to be both a comprehensive GUI and an integrated development environment for R.

RKWard is a free open-source implementation of the R statistical computing language and programming environment. The current status of R is a command line driven interface environment, but recently there have been several projects that have added GUIs to R, which aims to be both a comprehensive GUI and an integrated development environment for R.

1. Background and motivation

In mid 1993 Ihaka and Gentleman published initial efforts on the computing language and programming environment R on the s-news mailing list. Ambitions for this project were to provide an excellent tool to manage the computing language and statistical software, R.

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Abstract

R is a free open-source implementation of the R statistical computing language and programming environment. The current status of R is a command line driven interface environment, but recently there have been several projects that have added GUIs to R, which aims to be both a comprehensive GUI and an integrated development environment for R. RKWard is a free open-source implementation of the R statistical computing language and programming environment. The current status of R is a command line driven interface environment, but recently there have been several projects that have added GUIs to R, which aims to be both a comprehensive GUI and an integrated development environment for R.

Keywords: GUI, statistical software, R.

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GUIs for R

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 RKWard | about

▶ combines GUI and IDE
   ▶ to satisfy both newbies and gurus
   ▶ easy to extend
▶ mere desktop application
   ▶ no server, but R backend configurable
▶ multi-platform (thanks to Qt)
   ▶ MS Windows
   ▶ OS X
   ▶ GNU/Linux
▶ free software (GPL v2+)
▶ download: http://rkward.kde.org
   ▶ part of the KDE family
RKWard | is brought to you by

- thomas friedrichsmeier
  - and many others...
- until now 48 official releases
- some milestones:
  - 0.1.0 (19.11.2002) first release
  - 0.4.0 (17.10.2006) i joined the team ;o)
  - 0.5.1 (04.08.2009) windows port
  - 0.5.5 (15.03.2011) external plugins
  - 0.6.0 (24.12.2012) OS X port
  - 0.6.4 (21.12.2015) most recent release
Welcome to RKWard

Summary
This help page gives a rough overview of the most important parts of RKWard.
By default, this page is shown each time RKWard is started. You can disable or re-enable this behavior under Settings->Configure RKWard->General.

Introduction to RKWard
RKWard is a GUI front-end and IDE to R, a powerful scripting language for statistical computing. It aims to provide useful features both to experienced users of R, wishing to exploit R's scripting capabilities, as well as to users new to R, looking for an easy way to carry out statistical computation tasks.

Getting Started
Due to the large differences in prior knowledge of R, we provide two different guides for getting started with RKWard. The first is aimed at users with some knowledge of the R language, and focuses on introducing the IDE features of RKWard: RKWard for R Users.
The second gives a more hands on introduction to getting started with RKWard, but does not go quite as deep. If you have never used R or RKWard before, you should start with this guide, then later read the above page link: RKWard for new Users.

Trouble Shooting
If you encounter problems please feel free to search in Trouble Shooting First.

Missing something?
Are you missing a particular GUI dialog in the current menu? A growing number of plugins is available for separate download as R packages. See what’s available for installation at Settings->Manage R packages and plugins. In the R package installation section, you can select to show packages providing graphics dialogs for RKWard.

Still missing something?
Check out the Introduction to Writing Plugins For RKWard to learn how easy it is to enhance RKWard with your custom dialogs. And if you like, how to share your work with the community of RKWard users. See the rkward package overview for RKWard specific function for development and scripting. As another way of contributing, consider supporting the development of RKWard with money. One easy way to give a small amount is donating via Flattr.

General Information

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### t.test (stats)

**Student's t-Test**

**Description**
Performs one and two sample t-tests on vectors of data.

**Usage**

t.test(x, ...)

```
## Default S3 method:
t.test(x, y = NULL,
    alternative = c("two.sided", "less", "greater"),
    mu = 0, paired = FALSE, var.equal = FALSE,
    conf.level = 0.95, ...)
```

```
## S3 method for class 'formula'
t.test(formula, data, subset, na.action, ...)
```

**Arguments**

- `x`  a (non-empty) numeric vector of data values.
- `y`  an optional (non-empty) numeric vector of data values.

---

```r
> summary(sleep)
extra  group  ID
 Min. :1.600 1:10 1 :2
 1st Qu.:0.000 2:10 2 :2
    Median :0.490 3 :2
    Mean :1.540 4 :2
  3rd Qu.:3.400 5 :2
    Max. :5.500 6 :2
(Other):8
```

```r
> ?t.test
```

---

RKWard | main window: online help
Two-sample \( t \) test power calculation

Parameters

- Parameter to determine: Sample size
- alternative: two sided

Mon Feb 8 22:30:07 2016

<table>
<thead>
<tr>
<th>Parameters</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>( n )</td>
<td>175.3847</td>
</tr>
<tr>
<td>( d )</td>
<td>0.3000</td>
</tr>
<tr>
<td>sig.level</td>
<td>0.0500</td>
</tr>
<tr>
<td>power</td>
<td>0.8000</td>
</tr>
</tbody>
</table>

Note: \( n \) is number in "each" group

Interpretation of effect size \( d \) (according to Cohen):

<table>
<thead>
<tr>
<th>small</th>
<th>medium</th>
<th>large</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2</td>
<td>0.5</td>
<td>0.8</td>
</tr>
</tbody>
</table>

Run again

\[ \text{summary(sleep)} \]

<table>
<thead>
<tr>
<th>extra</th>
<th>group</th>
<th>ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min.</td>
<td>1.600</td>
<td>1</td>
</tr>
<tr>
<td>1st Qu.</td>
<td>0.625</td>
<td>1</td>
</tr>
<tr>
<td>Median</td>
<td>0.950</td>
<td>3</td>
</tr>
<tr>
<td>Mean</td>
<td>1.540</td>
<td>4</td>
</tr>
<tr>
<td>3rd Qu.</td>
<td>3.400</td>
<td>5</td>
</tr>
<tr>
<td>Max.</td>
<td>5.500</td>
<td>6</td>
</tr>
</tbody>
</table>

\( > \text{t.test} \)
GUIs for R

RK Ward

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**GUIs for R**

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  - plots
  - packages
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- **extendable plugin concept**
- **rkwarddev**

**feedback**

**thx**

---

**RKWard | dialog windows**

**data**
- ANOVA
- Generate random data
- Multiple Choice
- Recode categorical data
- Sort data
- Subset data frame

**analysis**
- Basic Statistics
- Descriptive Statistics
- ANOVA
- Cluster analysis
- Cohen's Kappa
- Correlation
- Crosstabs
- Factor analysis
- Item Response Theory
- means
- Moments
- Multidimensional scaling
- Multiple Choice
- Outlier Tests
- Power Analysis
- Regression
- Text Analysis
- Time Series
- Variances / Scale
- Wilcoxon Tests

**plots**
- Barplot
- Box Plot
- Cluster analysis
- Density Plot
- Dotchart
- ECDF Plot
- Factor analysis
- Generic Plot
- Histogram
- Interaction plot
- Item Response Theory
- Pareto Chart
- Piechart
- Scatterplot
- Scatterplot Matrix
- Stem-and-Leaf Plot
- Stripchart

---

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RKWard | dialogs: power analysis

Select a method
- t-Tests of means

Number of groups
- 2

Samples
- Two samples (equal sizes)

Using test hypothesis
- Two-sided

Parameter to determine
- Power of test

Sample size
- 30

Effect size
- 0.3

Significance level
- 0.05

Known measures
- Power
  - 0.8

Auto close

Save results to workspace

Preview

Parent object: GlobalEnv

Preview disabled

Code Preview

Cohen's d

Measure for selected method is

Significance level
- 0.05

Parameter count

Submit

Close

Help
RK Ward | dialogs: mandatory fields

Select Variable(s)

Name      | Label | Type   | Class
---|---|---|---
sleep ID  |       | Factor | dataframe
sleep extra |       | Numeric | numeric
sleep group |       | Factor | factor

Test Form
Independent samples

Compare

Assume equal variances

Using test hypothesis
- Two-sided
- First is greater
- Second is greater

Submit Close Help Use Wizard
GUIs for R

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RKWard | dialogs: code

```
## Compute
t.test (x, y, alternative="two.sided")
## Print result
rk.header (result$method, parameters=list("Comparing"=names[1],
  "against"=names[2],
  "Hi"=rk.describe.alternative (result),
  "Equal variances"="not assumed"))

rk.results (list [
  "Variable Name"=names,
  "estimated mean"=result$estimate,
])
```
RKWard | dialogs: wizard

As a first step, select the type of test to conduct.

Select "Independent samples" when comparing data from two different populations (e.g., treatment group vs. control group). For comparing matched pairs or repeated measures on the same subject, select "Paired samples". Finally, you can also test a single sample against a constant value.

Test form

Independent samples

Cancel  Help  Use Dialog  Next >
t-Test

Use t-Test now

Summary
t-Test (two variable paired or independent samples, or one variable).

Usage
Choose two numeric vectors or one vector and a constant to compare against each other. For two samples, specify whether the variables are paired or independent samples. For details, see below.

GUI settings

Basic settings
Test form
Choose whether you want a two samples test (paired samples or independent samples), or to test a single variable against a constant
compare
A numeric vector for the first variable
against
A numeric vector for the second variable. Available for two samples tests only.
against
A numeric constant. Available for tests against constant only
assume equal variances
Whether to assume equal variances for the two samples (for independent samples t-test, only). This option is implied for a paired test
using test hypothesis
Alternative hypothesis (H1) of the test.

Options
Show Confidence Interval
Whether to print the confidence interval of the estimated mean.
R console & code editor
RKWard | R console & code editor

- syntax highlighting
- code hinting
- code folding
- code blocks
working with data
import/edit/export
RK Ward | data import/export

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RK Ward |

data import/export

New
Open R Script File... Ctrl+O
Open Recent R Script File

Import
Export
Quit Ctrl+Q

Import format
Import Excel files (Java based)
Import Excel files (Perl based)

Import SPSS
Import Stata
Import Text / CSV data

RK Ward | https://rkward.kde.org | twitter: @RKWordNet
RKWard | import SPSS files

**GUIs for R**
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- thx

---

**RKWard**

**Import SPSS file**

- **General**
  - File name: T/All/SPSS/SPSS 29.09.3/Exploring data/SexBloodWeight.sav
  - Object to save to: my.spss.data
  - **Auto close**

- **Encoding**
  - **Edit Object**

- **Object to save to**
  - Parent object: Global Env

- **Convert Variable labels to RKWard format**
- **Use value labels**

- **Maximum number of labels per object**
  - 1000000

- **Trim white space**

**Preview**

<table>
<thead>
<tr>
<th>Name</th>
<th>Case</th>
<th>Bloodtype</th>
<th>Sex</th>
<th>Height</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Group 0</td>
<td>Male</td>
<td>178</td>
<td>75</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>Group 0</td>
<td>Male</td>
<td>195</td>
<td>100</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>Group A</td>
<td>Male</td>
<td>145</td>
<td>60</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>Group 0</td>
<td>Male</td>
<td>170</td>
<td>71</td>
</tr>
</tbody>
</table>
**RKWard** | export CSV files

### GUIs for R

- **RKWard**
  - dialogs
  - console/editor

- **data**
  - plots
  - packages
  - configuration

### Extendable

- plugin concept
- rkwarddev

### Feedback

- thx

**RKWard**

- export CSV files

![Export Table / CSV files dialog](https://rkward.kde.org)

**Data and File Format**

- **Rows and Columns**
  - Select a variable or table

<table>
<thead>
<tr>
<th>Name</th>
<th>Label</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>sleep</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Encoding and Character Options**

- **Save to**
  - tmp/sleep.csv

- **Append to file if it exists**

**File Format**

- Comma separated values (CSV)

- **Decimal point character**
  - . (Period)
  - , (Comma)
  - Custom (specify below)

- **Field separator character**
  - Tab
  - ; (Semicolon)
  - , (Comma)
  - Space
  - Custom (specify below)

**Contact**

- Dipl. Psych. M·Eik Michalke
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- Twitter: @RKWardNet
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plots
preview, history & export
RKWard | plot preview, history & export


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[Image of RKWard interface with a graph showing sales development from 2003 to 2009]

RKWard | plot preview, history & export

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RKWard | export to TikZ format (\LaTeX)

Sales development 2003-2009


- Illegal downloads (tracks)
- CD sales (albums)
- Payed downloads (tracks)
- CD sales (singles)
- Payed downloads (bundles)
# RKWard | R packages: installed locally

## GUIs for R
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## RKWard

![RKWard GUI](image)

### Configure Packages - RKWard

<table>
<thead>
<tr>
<th>Status</th>
<th>Name</th>
<th>Title Version</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Installed Packages</td>
<td>1.3.13 -&gt; 1.3.15</td>
<td>Ausr/lib/R/library -&gt; http://...</td>
</tr>
<tr>
<td></td>
<td>New Packages</td>
<td>7.3.11 -&gt; 7.3.12</td>
<td>Ausr/lib/R/library -&gt; http://...</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.2.4 -&gt; 1.2.5</td>
<td>Ausr/lib/R/site-library -&gt; h...</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.8.62 - 0.8.63</td>
<td>Ausr/lib/R/library -&gt; http://...</td>
</tr>
<tr>
<td>✓</td>
<td>KernSmooth</td>
<td>2.23-13 -&gt; 2.2...</td>
<td>Ausr/lib/R/library -&gt; http://...</td>
</tr>
<tr>
<td></td>
<td>lattice</td>
<td>0.20-29 -&gt; 0.2...</td>
<td>Ausr/lib/R/library -&gt; http://...</td>
</tr>
<tr>
<td></td>
<td>mailR</td>
<td>0.03-1 -&gt; 0.4.1</td>
<td>/home/mR -&gt; <a href="http://ftp5">http://ftp5</a>...</td>
</tr>
<tr>
<td></td>
<td>MASS</td>
<td>7.3-37 -&gt; 7.3-39</td>
<td>Ausr/lib/R/library -&gt; http://...</td>
</tr>
<tr>
<td></td>
<td>mgcv</td>
<td>1.8-4 -&gt; 1.8-5</td>
<td>Ausr/lib/R/library -&gt; http://...</td>
</tr>
<tr>
<td></td>
<td>nline</td>
<td>3.1-119 -&gt; 3.1...</td>
<td>Ausr/lib/R/library -&gt; http://...</td>
</tr>
<tr>
<td></td>
<td>nnet</td>
<td>7.0-8 -&gt; 7.0-9</td>
<td>Ausr/lib/R/library -&gt; http://...</td>
</tr>
<tr>
<td></td>
<td>plotrix</td>
<td>3.5-7 -&gt; 3.5-11</td>
<td>Ausr/lib/R/site-library -&gt; h...</td>
</tr>
<tr>
<td></td>
<td>pwr</td>
<td>1.1.1 -&gt; 1.1.2</td>
<td>Ausr/lib/R/site-library -&gt; h...</td>
</tr>
<tr>
<td></td>
<td>Rcpp</td>
<td>0.11.4 -&gt; 0.11.5</td>
<td>Ausr/lib/R/site-library -&gt; h...</td>
</tr>
<tr>
<td></td>
<td>rpart</td>
<td>4.1-8 -&gt; 4.1-9</td>
<td>Ausr/lib/R/library -&gt; http://...</td>
</tr>
<tr>
<td></td>
<td>survival</td>
<td>2.37-7 -&gt; 2.38-1</td>
<td>Ausr/lib/R/library -&gt; http://...</td>
</tr>
<tr>
<td></td>
<td>xtable</td>
<td>1.7-1 -&gt; 1.7-4</td>
<td>Ausr/lib/R/site-library -&gt; h...</td>
</tr>
</tbody>
</table>

### Configure Repositories

- Install packages to:
- /home/mR/

- Select all updates
- Show only packages matching:
- Show only packages providing RKWard dialogs
- Install suggested packages

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GUIs for R
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 RKWard | the plugin concept

- **dialogs** are implemented as plugins
  - QA: support for unit tests
  - i18n: support for translations
- you can **extend RKWard** with your own plugins
  - can be packaged/installed as **R packages**
  - [https://github.com/rkward-community](https://github.com/rkward-community)
    - rk.ANOVA
    - rk.ClusterAnalysis
    - rk.FactorAnalysis
    - rk.gitInstall
    - rk.MultidimensionalScaling
    - ...

---

**RKWard**
- dialogs
- console/editor
- data
- plots
- packages
- configuration

**extendable**
- plugin concept

**rkwarddev**

**feedback**

**thx**
RKWard | plugins: XML & JavaScript

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RKWard

<table>
<thead>
<tr>
<th>plugins: XML &amp; JavaScript</th>
</tr>
</thead>
<tbody>
<tr>
<td>XML</td>
</tr>
<tr>
<td>JS</td>
</tr>
</tbody>
</table>

---

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**RKWard | example: radio button**

**radio button: define GUI in XML**

```xml
<radio id="hypothesis" label="using test hypothesis">
    <option value="two.sided" label="Two-sided" />
    <option value="greater" label="First is greater" />
    <option value="less" label="Second is greater" />
</radio>
```
radio button: generate R code with JavaScript

```javascript
var hypothesis = getValue("hypothesis");
var x = getValue("x");
var y = getValue("y");
echo("result <- t.test (x=" + x + ", y=" + y);
echo(" , alternative=" + hypothesis + "\n");
```

```r
local{
  ## Vorbereiten
  names <- rk.get.description (, )
  ## Berechne
  result <- t.test (x=, y=, alternative="two.sided")
  ## Drucke Ergebnisse
  rk.header(result$method, parameters=list("Comparing"=names[1],
"against"=names[2],
"H1"=rk.describe.alternative (result),
"Equal variances"="not assumed"))
```
GUIs for R

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RKWard plugin development with the rkwarddev package

m.eik michalke

November 9, 2014

Writing plugins for RKWard means writing at least two XML files (a GUI description and a plugin map), one JavaScript file (to create the R code), maybe a help file (again in XML), and for plugins who should be distributable, a DESCRIPTION file. Furthermore, all of these files need to be in a certain directory structure. Writing plugins can be quite tricky, by needing you to manually fill in all the listed tasks in just one R script.

1 About the package

You might ask why you should write R scripts to generate plugins, if you could just directly write the XML and JavaScript files. First of all, you don't have to use this package at all, it's totally fine to code your plugins however you like. The main reason why I wrote this package is that I like to really concentrate on what I'm doing, so that I can avoid switching between several files in three different languages all the time. I wanted to be able to constantly "think in R" while working on creating a plugin. Another benefit is the possibility of rapid prototyping, such that a lot of useful automation was implemented, so using this package will definitely save you quite some amount of typing.

2 Before we start

It is important to understand that while rkwarddev can help you to make designing new plugins much easier, you still need to learn how the generated XML and JavaScript files work and behave. That is, if you didn't read the Introduction to Writing Plugins for RKWard, please do so before you start working with this package. Once you've read this guide you understand how plugins in RKWard are built, just come back here.

```
> rk.plugin.skeleton(
+ about="Example plugin",
+ xml=list(dialog=myDialog),
+ load=TRUE,
+ show=TRUE
+)
```

For filenames 'Example plugin' was renamed to 'Exampleplugin'.
Created directory /tmp/Rtmp9gdThb/Exampleplugin.
Created directory /tmp/Rtmp9gdThb/Exampleplugin/inst/
Created directory /tmp/Rtmp9gdThb/Exampleplugin/inst/rkward/plugins/Exampleplugin.
For filenames 'Example plugin' was renamed to 'Exampleplugin'.
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For filenames 'Example plugin' was renamed to 'Exampleplugin'.
[1] 
```
```
RKWard | XML with rkwarddev

functions for XML & JavaScript

```r
> hypo <- rk.XML.radio(label="using test hypothesis", id.name="hypothesis",
+     options=list(
+     "Two-sided"=c(val="two.sided"),
+     "First is greater"=c(val="greater"),
+     "Second is greater"=c(val="less"))
+ )
+ )
> hypo
<radio id="hypothesis" label="using test hypothesis">
   <option label="Two-sided" value="two.sided" />
   <option label="First is greater" value="greater" />
   <option label="Second is greater" value="less" />
</radio>
> cat(echo("\n", alternative="", hypo, \\
"\n")
echo("\n", alternative="" + hypothesis + "\n");
```
»developers, developers, developers...«
RKWard | feedback

- download: http://rkward.kde.org
- feedback: rkward-devel@kde.org
- twitter: @RKWardNet
thx!

questions? ideas? comments?
<meik.michalke@hhu.de>
twitter: @yrlaNor

references

