Getting Started With the R Commander*

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26 August 2006

1 Starting the R Commander

Once R is running, simply loading the `Rcmdr` package by typing the command `library(Rcmdr)` into the *R Console* starts the R Commander graphical user interface ("GUI"). To function properly under Windows, the R Commander requires the single-document interface (SDI) to R.[1] After loading the package, *R Console* and *R Commander* windows should appear more or less as in Figures 1 and 2. These and other screen images in this document were created under Windows XP; if you use another version of Windows (or, of course, another computing platform), then the appearance of the screen may differ.[2]

The *R Commander* and *R Console* windows float freely on the desktop. You will normally use the menus and dialog boxes of the R Commander to read, manipulate, and analyze data.

- R commands generated by the R Commander GUI appear in the upper text window (labelled *Script Window*) within the main *R Commander* window. You can also type R commands directly into the script window or at the > (greater-than) prompt in the *R Console*; the main purpose of the R Commander, however, is to avoid having to type commands.
- Printed output appears by default in the second text window (labelled *Output Window*).
- The lower, gray window (labelled *Messages*) displays error messages, warnings, and some other information ("notes"), such as the start-up message in Figure 2.
- When you create graphs, these will appear in a separate *Graphics Device* window.

*This manual is adapted and updated from Fox (2005). Please address correspondence to `jfox@mcmaster.ca`.

[1] The Windows version of R is normally run from a multiple-document interface ("MDI"), which contains the *R Console* window, *Graphical Device* windows created during the session, and any other windows related to the R process. In contrast, under the single-document interface ("SDI"), the *R Console* and *Graphical Device* windows are not contained within a master window. There are several ways to run R in SDI mode — for example, by editing the `Rconsole` file in R's `etc` subdirectory, or by adding `--sdi` to the *Target* field in the *Shortcut* tab of the R desktop icon's *Properties*. This limitation of the `Rcmdr` package is inherited from the `tcltk` package, on which `Rcmdr` depends.

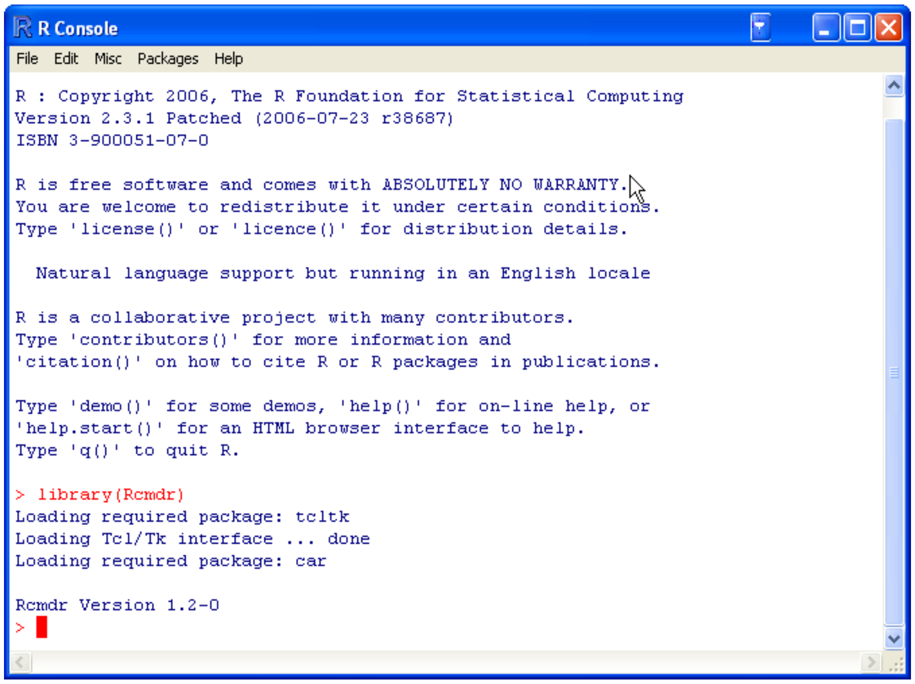
[2] Notice that `Rcmdr` requires some packages in addition to several of the "recommended" packages that are normally distributed with R, and loads these packages at startup. `Rcmdr`, the required packages, and many other contributed packages are available for download from the Comprehensive R Archive Network (CRAN) at <http://cran.r-project.org/>.

If these packages are not installed, the `Rcmdr` will offer to install them from the Internet or from local files (e.g., on a CD/ROM). If you install the `Rcmdr` package via the Windows "R GUI," the packages on which the `Rcmdr` depends should be installed automatically. More generally, you can install the `Rcmdr` package and all of the packages on which it depends via the `install.packages` function, setting the argument `dependencies = TRUE`.

Thanks to Dirk Eddelbuettel, Debian Linux users need only issue the command `$ apt-get install r-cran-rcmdr` to install the `Rcmdr` package along with all of the packages that it requires. In any event, building and installing the `Rcmdr` package on Linux systems is typically straightforward. The task can be more formidible under OS/X on Macinstosh systems, since the `tcltk` package on which the `Rcmdr` depends requires that Tcl/Tk be installed and that R is running under X-Windows.

To enable 3D graphics in the `Rcmdr`, install the `rgl` package.

Additional information about installation is available at the R Commander web page, <`http://socserv.socsci.mcmaster.ca/jfox/Misc/Rcmdr/index.html`>.



```
R : Copyright 2006, The R Foundation for Statistical Computing
Version 2.3.1 Patched (2006-07-23 r38687)
ISBN 3-900051-07-0

R is free software and comes with ABSOLUTELY NO WARRANTY.
You are welcome to redistribute it under certain conditions.
Type 'license()' or 'licence()' for distribution details.

  Natural language support but running in an English locale

R is a collaborative project with many contributors.
Type 'contributors()' for more information and
'citation()' on how to cite R or R packages in publications.

Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

> library(Rcmdr)
Loading required package: tcltk
Loading Tcl/Tk interface ... done
Loading required package: car

Rcmdr Version 1.2-0
>
```

Figure 1: The *R Console* window after loading the `Rcmdr` package.

There are several menus along the top of the *R Commander* window:

File Menu items for loading and saving script files; for saving output and the R workspace; and for exiting.

Edit Menu items (*Cut*, *Copy*, *Paste*, etc.) for editing the contents of the script and output windows. Right clicking in the script or output window also brings up an edit "context" menu.

Data Submenus containing menu items for reading and manipulating data.

Statistics Submenus containing menu items for a variety of basic statistical analyses.

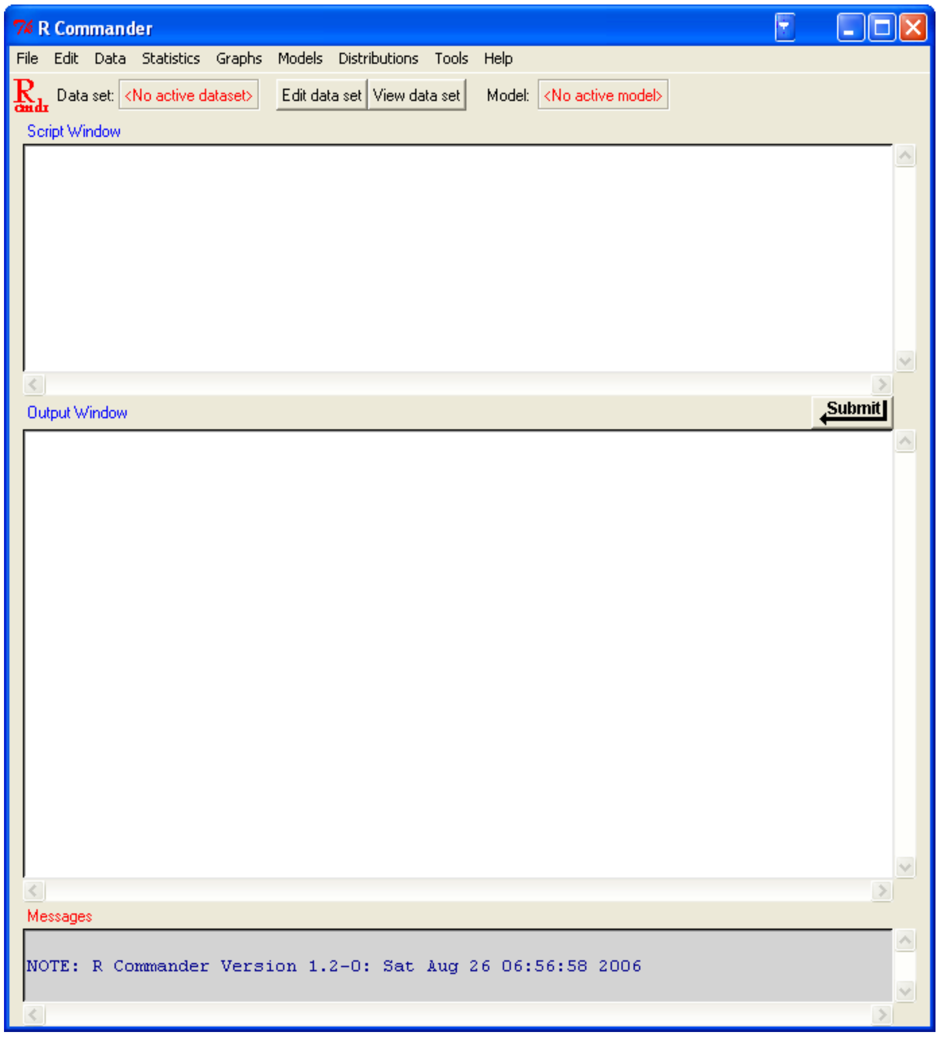
Graphs Menu items for creating simple statistical graphs.

Models Menu items and submenus for obtaining numerical summaries, confidence intervals, hypothesis tests, diagnostics, and graphs for a statistical model, and for adding diagnostic quantities, such as residuals, to the data set.

Distributions Probabilities, quantiles, and graphs of standard statistical distributions (to be used, for example, as a substitute for statistical tables) and samples from these distributions.

Tools Menu items for loading R packages unrelated to the `Rcmdr` package (e.g., to access data saved in another package), and for setting some options.

Help Menu items to obtain information about the R Commander (including this manual). As well, each R Commander dialog box has a *Help* button (see below).



```
NOTE: R Commander Version 1.2-0: Sat Aug 26 06:56:58 2006
```

Figure 2: The *R Commander* window at start-up

The complete menu "tree" for the R Commander (version 1.2-0) is shown below. Most menu items lead to dialog boxes, as illustrated later in this paper. Menu items are inactive ("grayed out") if they are inapplicable to the current context.

```
File - Open script file
    |- Save script
    |- Save script as
    |- Save output
    |- Save output as
    |- Save R workspace
    |- Save R workspace as
    |- Exit - from Commander
           |- from Commander and R


Edit - Clear Window
    |- Cut
    |- Copy
    |- Paste
    |- Delete
    |- Find
    |- Select all

Data - New data set
    |- Import data - from text file or clipboard
    |             |- from SPSS data set
    |             |- from Minitab data set
    |             |- from STATA data set
    |             |- from Excel, Access, or dBase data set
    |- Data in packages - List data sets in packages
    |                  |- Read data set from attached package
    |- Active data set - Select active data set
    |                 |- Refresh active data set
    |                 |- Help on active data set (if available)
    |                 |- Variables in active data set
    |                 |- Set case names
    |                 |- Subset active data set
    |                 |- Stack variables in active data set
    |                 |- Remove cases with missing data
    |                 |- Export active data set
    |- Manage variables in active data set - Recode variable
                                          |- Compute new variable
                                          |- Add observation numbers to data set
                                          |- Standardize variables
                                          |- Convert numeric variables to factors
                                          |- Bin numeric variable
                                          |- Reorder factor levels
                                          |- Define contrasts for a factor
                                          |- Rename variables
                                          |- Delete variables from data set

Statistics - Summaries - Active data set
          |           |- Numerical summaries
          |           |- Frequency distributions
          |           |- Table of statistics
          |           |- Correlation matrix
          |           |- Correlation test
          |- Contingency Tables - Two-way table
          |                    |- Multi-way table
          |                    |- Enter and analyze two-way table
          |- Means - Single-sample t-test
          |       |- Independent-samples t-test
          |       |- Paired t-test
          |       |- One-way ANOVA
          |       |- Multi-way ANOVA
          |- Proportions - Single-sample proportion test
          |             |- Two-sample proportions test
          |- Variances - Two-variances F-test
          |           |- Bartlett's test
          |           |- Levene's test
          |- Nonparametric tests - Two-sample Wilcoxon test
          |                     |- Paired-samples Wilcoxon test
          |                     |- Kruskal-Wallis test
          |- Dimensional analysis - Scale reliability
          |                      |- Principal-components analysis
          |                      |- Factor analysis
          |                      |- Cluster analysis - k-means cluster analysis
          |                                         |- Hierarchical cluster analysis
          |                                         |- Summarize hierarchical clustering
          |                                         |- Add hierarchical clustering to data set
          |- Fit models - Linear regression
                       |- Linear model
                       |- Generalized linear model
                       |- Multinomial logit model
                       |- Proportional-odds logit model

Graphs - Index plot
      |- Histogram
      |- Stem-and-leaf display
      |- Boxplot
      |- Quantile-comparison plot
      |- Scatterplot
      |- Scatterplot matrix
      |- Line graph
      |- XY conditioning plot
      |- Plot of means
      |- Bar graph
      |- Pie chart
      |- 3D graph - 3D scatterplot
      |          |- Identify observations with mouse
      |          |- Save graph to file
      |- Save graph to file - as bitmap
                           |- as PDF/Postscript/EPS
                           |- 3D RGL graph

Models - Select active model
      |- Summarize model
      |- Add observation statistics to data
      |- Confidence intervals
      |- Hypothesis tests - ANOVA table
      |                   |- Compare two models
      |                   |- Linear hypothesis
      |- Numerical diagnostics - Variance-inflation factors
      |                        |- Breusch-Pagan test for heteroscedasticity
      |                        |- Durbin-Watson test for autocorrelation
      |                        |- RESET test for nonlinearity
      |                        |- Bonferroni outlier test
      |- Graphs - Basic diagnostic plots
               |- Residual quantile-comparison plot
               |- Component+residual plots
               |- Added-variable plots
               |- Influence plot
               |- Effect plots

Distributions - Continuous distributions - Normal distribution - Normal quantiles
             |             |                      |- Normal probabilities
             |             |                      |- Plot normal distribution
             |             |                      |- Sample from normal distribution
             |             |- t distribution - t quantiles
             |             |                 |- t probabilities
             |             |                 |- Plot t distribution
             |             |                 |- Sample from t distribution
             |             |- Chi-squared distribution - Chi-squared quantiles
             |             |                           |- Chi-squared probabilities
             |             |                           |- Plot chi-squared distribution
             |             |                           |- Sample from chi-squared distribution
             |             |- F distribution - F quantiles
             |             |                 |- F probabilities
             |             |                 |- Plot F distribution
             |             |                 |- Sample from F distribution
             |             |- Exponential distribution - Exponential quantiles
             |             |                           |- Exponential probabilities
             |             |                           |- Plot exponential distribution
             |             |                           |- Sample from exponential distribution
             |             |- Uniform distribution - Uniform quantiles
             |             |                       |- Uniform probabilities
             |             |                       |- Plot uniform distribution
             |             |                       |- Sample from uniform distribution
             |             |- Beta distribution - Beta quantiles
             |             |                    |- Beta probabilities
             |             |                    |- Plot beta distribution
             |             |                    |- Sample from beta distribution
             |             |- Cauchy distribution - Cauchy quantiles
             |             |                      |- Cauchy probabilities
             |             |                      |- Plot Cauchy distribution
             |             |                      |- Sample from Cauchy distribution
             |             |- Logistic distribution - Logistic quantiles
             |             |                        |- Logistic probabilities
             |             |                        |- Plot logistic distribution
             |             |                        |- Sample from logistic distribution
             |             |- Lognormal distribution - Lognormal quantiles
             |             |                         |- Lognormal probabilities
             |             |                         |- Plot lognormal distribution
             |            |                        |- Sample from lognormal distribution
             |            |- Gamma distribution - Gamma quantiles
             |            |                    |- Gamma probabilities
             |            |                    |- Plot gamma distribution
             |            |                    |- Sample from gamma distribution
             |            |- Weibull distribution - Weibull quantiles
             |            |                      |- Weibull probabilities
             |            |                      |- Sample from Weibull distribution
             |            |- Gumbel distribution - Gumbel quantiles
             |                                  |- Gumbel probabilities
             |                                  |- Plot Gumbel distribution
             |                                  |- Sample from Gumbel distribution
             |- Discrete distributions - Binomial distribution - Binomial quantiles
                          |                       |- Binomial tail probabilities
                          |                       |- Binomial probabilities
                          |                       |- Plot binomial distribution
                          |                       |- Sample from binomial distribution
                          |- Poisson distribution - Poisson quantiles
                          |                     |- Poisson tail probabilities
                          |                     |- Poisson probabilities
                          |                     |- Plot Poisson distribution
                          |                     |- Sample from Poisson distribution
                          |- Geometric distribution - Geometric quantiles
                          |                       |- Geometric tail probabilities
                          |                       |- Geometric probabilities
                          |                       |- Plot geometric distribution
                          |                       |- Sample from geometric distribution
                          |- Hypergeometric distribution - Hypergeometric quantiles
                          |                     |- Hypergeometric tail probabilities
                          |                     |- Hypergeometric probabilities
                          |                     |- Plot hypergeometric distribution
                          |                     |- Sample from hypergeometric distribution
                          |- Negative binomial distribution - Negative binomial quantiles
                                                  |- Negative binomial tail probabilities
                                                  |- Negative binomial probabilities
                                                  |- Plot negative binomial distribution
                                                  |- Sample from negative binomial distribution

Tools - Load package(s)
     |- Options

Help - Commander help
    |- Introduction to the R Commander
    |- Help on active data set (if available)
    |- About Rcmdr
```

The R Commander interface includes a few elements in addition to the menus and dialogs:

- Below the menus is a “toolbar” with a row of buttons.
  - The left-most (flat) button shows the name of the active data set. Initially there is no active data set. If you press this button, you will be able to choose among data sets currently in memory (if there is more than one). Most of the menus and dialogs in the R Commander reference the active data set. (The *File*, *Edit*, and *Distributions* menus are exceptions.)
  - Two buttons allow you to open the R data editor to modify the active data set or a viewer to examine it. The data-set viewer can remain open while other operations are performed.[3]
  - A flat button indicates the name of the active statistical model — a linear model (such as a linear-regression model), a generalized linear model, a multinomial logit model, or a proportional-odds model.[4] Initially there is no active model. If there is more than one model in memory, you can choose among them by pressing the button.
- Immediately below the toolbar is the script window (so labelled), a large scrollable text window. As mentioned, commands generated by the GUI are copied into this window. You can edit the text in the script window or even type your own R commands into the window. Pressing the *Submit* button, which is at the right below the script window (or, alternatively, the key combination *Ctrl-r*, for “run”), causes the line containing the cursor to be submitted (or resubmitted) for execution. If several lines are selected (e.g., by left-clicking and dragging the mouse over them), then pressing *Submit* will cause all of them to be executed. Commands entered into the script window can extend over more than one line, but if they do, lines after the first must be indented with one or more spaces or tabs. The key combination *Ctrl-a* selects all of the text in the script window, and *Ctrl-s* brings up a dialog box to save the contents of the window.
- Below the script window is a large scrollable and editable text window for output. Commands echoed to this window appear in red, output in dark blue (as in the *R Console*).
- At the bottom is a small gray text window for messages. Error messages are displayed in red text, warnings in green, and other messages in dark blue. Errors and warnings also provide an audible cue by ringing a bell. Messages are scrolled up and out of sight at the next operation.

Once you have loaded the `Rcmdr` package, you can minimize the *R Console*. The *R Commander* window can also be resized or maximized in the normal manner. If you resize the R Commander, the width of subsequent R output is automatically adjusted to fit the output window.

The R Commander is highly configurable: I have described the default configuration here. Changes to the configuration can be made via the *Tools* $\longrightarrow$ *Options...* menu, or — much more extensively — by setting options in R.[5] See the `Rcmdr` help files for details.

[3]The data viewer, provided by the `showData` function from David Firth’s `relimp` package, can be slow for data sets with large numbers of variables. When the number of variables exceeds a threshold (initially set to 100), the R data editor is used instead to display the data set. To use the data editor regardless of the number of variables, set the threshold to 0. See the R Commander help file for details. A disadvantage of using the data editor to display the current data set is that the editor window cannot continue to be displayed while other operations are performed.

[4]Users can provide additional classes of statistical models by adding the necessary dialog boxes and menu items, and editing the `model-classes.txt` file in R’s `etc` directory.

[5]A menu item that terminates in ellipses (i.e., three dots, ...) leads to a dialog box; this is a standard GUI convention. In this document, $\longrightarrow$ represents selecting a menu item or submenu from a menu.

2 Data Input

Most of the procedures in the R Commander assume that there is an active data set.[6] If there are several data sets in memory, you can choose among them, but only one is active. When the R Commander starts up, there is no active data set.

The R Commander provides several ways to get data into R:

- You can enter data directly via *Data* ⟶ *New data set...*. This is a reasonable choice for a very small data set.
- You can import data from a plain-text ("ascii") file or the clipboard, from another statistical package (Minitab, SPSS, or Stata), or from an Excel, Access, or dBase data set.
- You can read a data set that is included in an R package, either typing the name of the data set (if you know it), or selecting the data set in a dialog box.

2.1 Reading Data From a Text File

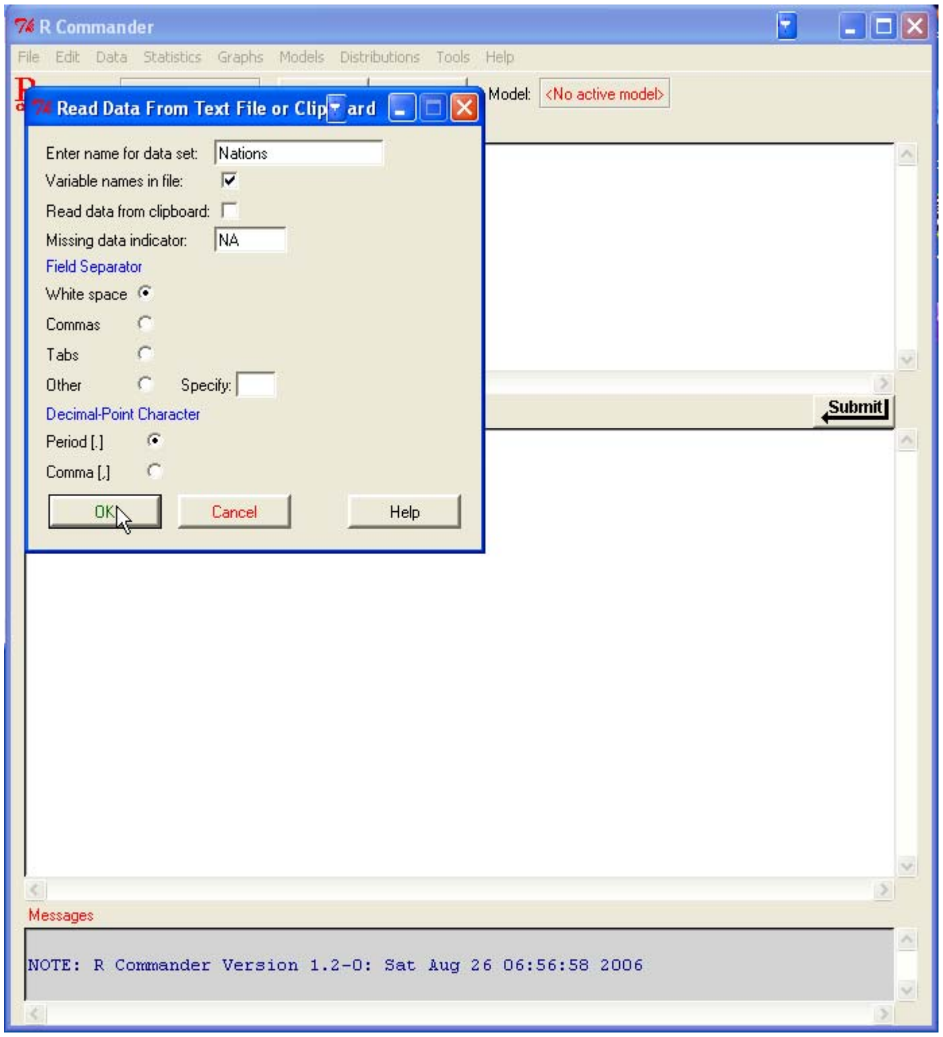
For example, consider the data file `Nations.txt`.[7] The first few lines of the file are as follows:

```
  TFR contraception  infant.mortality  GDP region
Afghanistan             6.90    NA  154  2848   Asia
Albania                 2.60    NA   32   863   Europe
Algeria                 3.81    52   44  1531   Africa
American-Samoa          NA      NA   11  NA     Oceania
Andorra                 NA      NA  NA   NA     Europe
Angola                  6.69    NA  124   355   Africa
Antigua                 NA      53   24  6966   Americas
Argentina               2.62    NA   22  8055   Americas
Armenia                 1.70    22   25   354   Europe
Australia               1.89    76    6 20046   Oceania
. . .
```

- The first line of the file contains variable names: `TFR` (the total fertility rate, expressed as number of children per woman), `contraception` (the rate of contraceptive use among married women, in percent), `infant.mortality` (the infant-mortality rate per 1000 live births), `GDP` (gross domestic product per capita, in U.S. dollars), and `region`.
- Subsequent lines contain the data values themselves, one line per country. The data values are separated by "white space" — one or more blanks or tabs. Although it is helpful to make the data values line up vertically, it is not necessary to do so. Notice that the data lines begin with the country names. Because we want these to be the "row names" for the data set, there is no corresponding variable name: That is, there are five variable names but six data values on each line. When this happens, R will interpret the first value on each line as the row name.
- Some of the data values are missing. In R, it is most convenient to use `NA` (representing "not available") to encode missing data, as I have done here.
- The variables `TFR`, `contraception`, `infant.mortality`, and `GDP` are numeric (quantitative) variables; in contrast, `region` contains region names. When the data are read, R will treat `region` as a "factor" — that is, as a categorical variable. In most contexts, the R Commander distinguishes between numerical variables and factors.

[6] Procedures selected under via the *Distributions* menu are exceptions, as is *Enter and analyze two-way table...* under the *Statistics* ⟶ *Contingency tables* menu.

[7] This file resides in the `etc` subdirectory of the `Rcmdr` package.


R Commander
File Edit Data Statistics Graphs Models Distributions Tools Help
Model: <No active model>
Read Data From Text File or Clipboard
Submit
Messages

Enter name for data set: Nations
Variable names in file: [✓]
Read data from clipboard: [ ]
Missing data indicator: NA

Field Separator
White space [✓]
Commas
Tabs
Other Specify:

Decimal-Point Character
Period [.] [✓]
Comma [,]

OK Cancel Help

```
NOTE: R Commander Version 1.2-0: Sat Aug 26 06:56:58 2006
```

Figure 3: Reading data from a text file.

To read the data file into R, select *Data* ⟶ *Import data* ⟶ *from text file...* from the *R Commander* menus. This operation brings up a *Read Data From Text File* dialog, as shown in Figure 3. The default name of the data set is `Dataset`. I have changed the name to `Nations`.

Valid R names begin with an upper- or lower-case letter (or a period, `.`) and consist entirely of letters, periods, underscores (`_`), and numerals (i.e., `0`–`9`); in particular, do not include any embedded blanks in a data-set name. You should also know that R is case-sensitive, and so, for example, `nations`, `Nations`, and `NATIONS` are distinguished, and could be used to represent different data sets.

Clicking the *OK* button in the *Read Data From Text File* dialog brings up an *Open* file dialog, shown in Figure 4. Here I navigated to the file `Nations.txt`. Clicking the *Open* button in the dialog will cause the data file to be read. Once the data file is read, it becomes the active data set in the R Commander. As a consequence, in Figure 5, the name of the data set appears in the data set button near the top left of the *R Commander* window.

I clicked the *View data set* button to bring up the data viewer window, also shown in Figure 5. Notice that the commands to read and view the `Nations` data set (the R `read.table` and `showData` commands) appear, partially obscured by the display of the data set, in the script and output windows. When the data set is read and becomes the active data set, a note appears in the messages window (and this is erased when the subsequent `showData` command is executed).

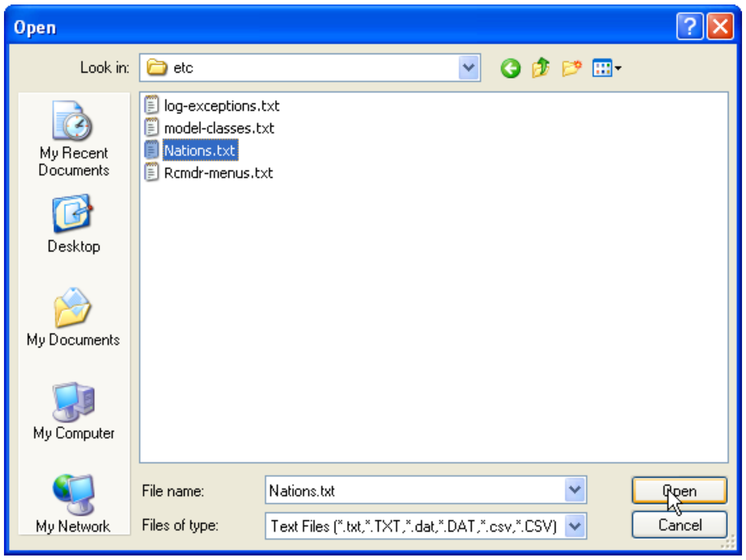


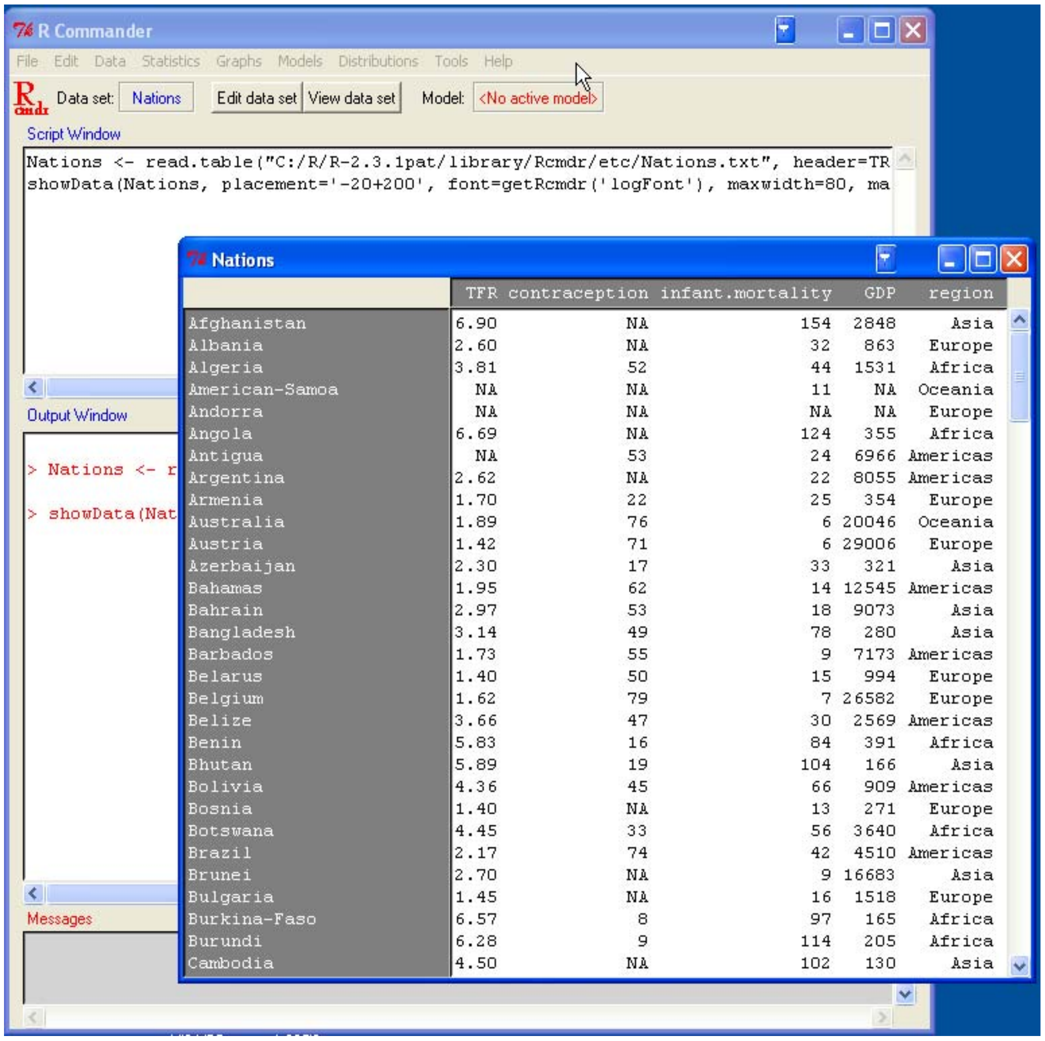
Figure 4: Open-file dialog for reading a text data file.

The `read.table` command creates an R "data frame," which is an object containing a rectangular cases-by-variables data set: The rows of the data set represent cases or observations and the columns represent variables. Data sets in the R Commander are R data frames.

2.2 Entering Data Directly

To enter data directly into the R spreadsheet-like data editor you can proceed as follows. As an example, I use a very small data set from Problem 2.44 in Moore (2000):

- Select *Data* ⟶ *New data set...* from the *R Commander* menus. Optionally enter a name for the data set, such as `Problem2.44`, in the resulting dialog box, and click the *OK* button. (Remember that R names cannot include intervening blanks.) This will bring up a *Data Editor* window with an empty data set.
- Enter the data from the problem into the first two columns of the data editor. You can move from one cell to another by using the arrow keys on your keyboard, by tabbing, by pressing the *Enter* key, or by pointing with the mouse and left-clicking. When you are finished entering the data, the window should look like Figure 6.
- Next, click on the name `var1` above the first column. This will bring up a *Variable editor* dialog box, as in Figure 7.
- Type the variable name `age` in the box, just as I have, and click the X button at the upper-right corner of the *Variable editor* window, or press the *Enter* key, to close the window. Repeat this procedure to name the second column `height`. The *Data Editor* should now look like Figure 8.
- Select *File* ⟶ *Close* from the *Data Editor* menus or click the X at the upper-right of the *Data Editor* window. The data set that you entered is now the active data set in the R Commander.



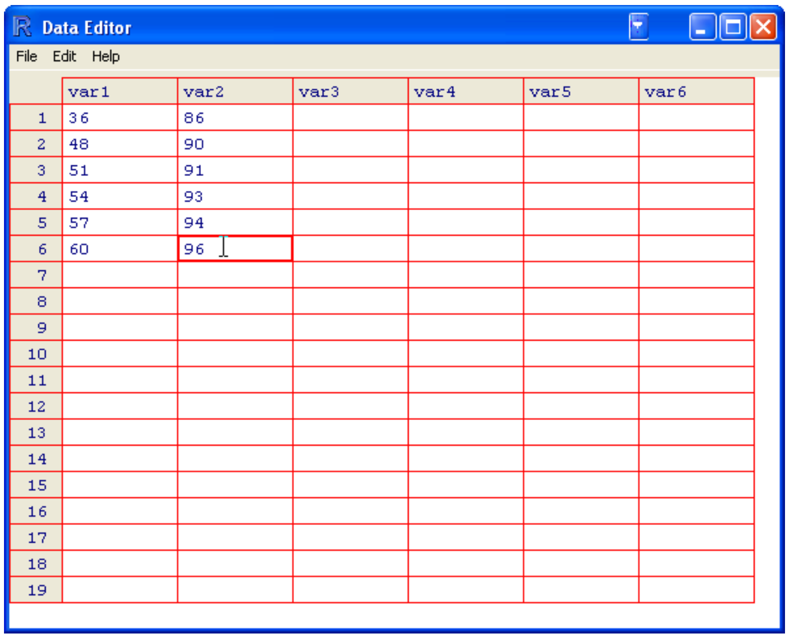
```
Nations <- read.table("C:/R/R-2.3.1pat/library/Rcmdr/etc/Nations.txt", header=TR
showData(Nations, placement='-20+200', font=getRcmdr('logFont'), maxwidth=80, ma
```

```
> Nations <- r

> showData(Nat
```

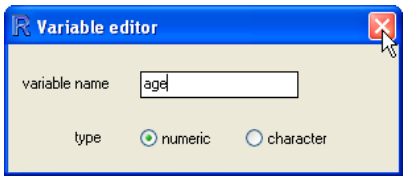
```
                TFR contraception infant.mortality   GDP   region
Afghanistan    6.90            NA              154  2848     Asia
Albania        2.60            NA               32   863   Europe
Algeria        3.81            52               44  1531   Africa
American-Samoa   NA            NA               11    NA  Oceania
Andorra          NA            NA               NA    NA   Europe
Angola         6.69            NA              124   355   Africa
Antigua          NA            53               24  6966 Americas
Argentina      2.62            NA               22  8055 Americas
Armenia        1.70            22               25   354   Europe
Australia      1.89            76                6 20046  Oceania
Austria        1.42            71                6 29006   Europe
Azerbaijan     2.30            17               33   321     Asia
Bahamas        1.95            62               14 12545 Americas
Bahrain        2.97            53               18  9073     Asia
Bangladesh     3.14            49               78   280     Asia
Barbados       1.73            55                9  7173 Americas
Belarus        1.40            50               15   994   Europe
Belgium        1.62            79                7 26582   Europe
Belize         3.66            47               30  2569 Americas
Benin          5.83            16               84   391   Africa
Bhutan         5.89            19              104   166     Asia
Bolivia        4.36            45               66   909 Americas
Bosnia         1.40            NA               13   271   Europe
Botswana       4.45            33               56  3640   Africa
Brazil         2.17            74               42  4510 Americas
Brunei         2.70            NA                9 16683     Asia
Bulgaria       1.45            NA               16  1518   Europe
Burkina-Faso   6.57             8               97   165   Africa
Burundi        6.28             9              114   205   Africa
Cambodia       4.50            NA              102   130     Asia
```

Figure 5: Displaying the active data set.



	var1	var2	var3	var4	var5	var6
1	36	86				
2	48	90				
3	51	91				
4	54	93				
5	57	94				
6	60	96				
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						

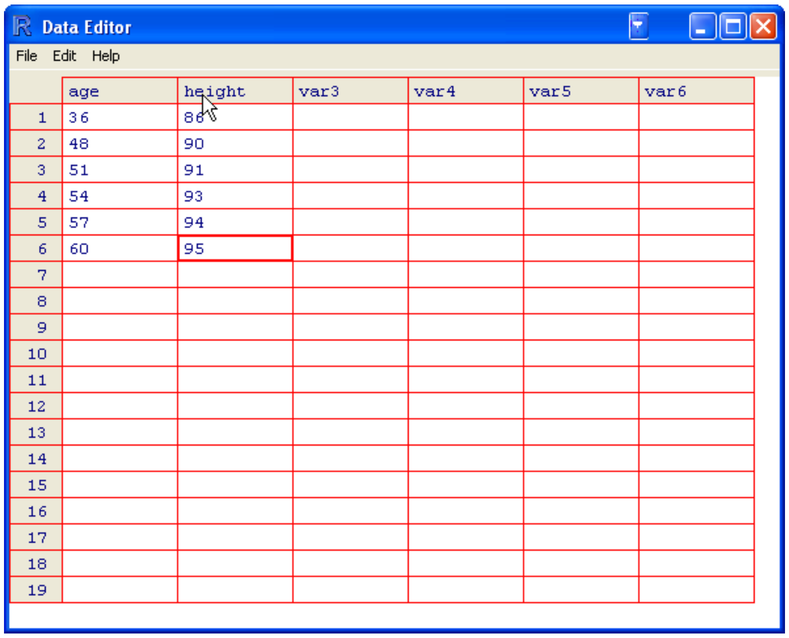
Figure 6: Data editor after the data are entered.



variable name: age

type: [✓ numeric] character

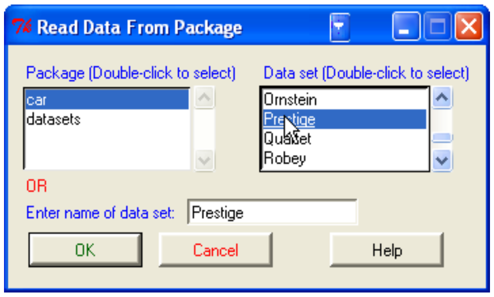
Figure 7: Dialog box for changing the name of a variable in the data editor.


Data Editor

File Edit Help

	age	height	var3	var4	var5	var6
1	36	86				
2	48	90				
3	51	91				
4	54	93				
5	57	94				
6	60	95				
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						

Figure 8: The *Data Editor* window after both variable names have been changed.


Read Data From Package

Package (Double-click to select): car, datasets

Data set (Double-click to select): Ornstein, Prestige, Quartet, Robey

OR

Enter name of data set: Prestige

Figure 9: Reading data from an attached package.

2.3 Reading Data from a Package

Many R packages include data. Data sets in packages can be listed in a pop-up window via *Data* ⟶ *Data in packages* ⟶ *List data sets in packages*, and can be read into the R Commander via *Data* ⟶ *Data in packages* ⟶ *Read data set from an attached package.*[8] The resulting dialog box is shown in Figure 9. If you know the name of a data set in a package then you can enter its name directly; otherwise double-clicking on the name of a package displays its data sets in the right list box; and double-clicking on a data set name copies the name to the data-set entry field in the dialog.[9] You can attach additional R packages by *Tools* ⟶ *Load packages.*

[8] Not all data in packages are data frames, and only data frames are suitable for use in the R Commander. If you try to read data that are not a data frame, an error message will appear in the messages window.

[9] In general in the R Commander, when it is necessary to copy an item from a list box to another location in a dialog, a double-click is required.

3 Creating Numerical Summaries and Graphs

Once there is an active data set, you can use the *R Commander* menus to produce a variety of numerical summaries and graphs. I will describe just a few basic examples here. A good GUI should be largely self-explanatory: I hope that once you see how the R Commander works, you will have little trouble using it, assisted perhaps by the on-line help files.

In the examples below, I assume that the active data set is the `Nations` data set, read from a text file in the previous section. If you typed in the five-observation data set from Moore (2000), or read in the `Prestige` data set from the `car` package, as were also described in the previous section, then one of these is the active data set. Recall that you can change the active data set by clicking on the flat button with the active data set's name near the top left of the *R Commander* window, selecting from among a list of data sets currently resident in memory.

Selecting *Statistics* $\longrightarrow$ *Summaries* $\longrightarrow$ *Active data set* produces the results shown in Figure 10. For each numerical variable in the data set (`TFR`, `contraception`, `infant.mortality`, and `GDP`), R reports the minimum and maximum values, the first and third quartiles, the median, and the mean, along with the number of missing values. For the categorical variable `region`, we get the number of observations at each "level" of the factor. Had the data set included more than ten variables, the R Commander would have asked us whether we really want to proceed — potentially protecting us from producing unwanted voluminous output.

Similarly, selecting *Statistics* $\longrightarrow$ *Summaries* $\longrightarrow$ *Numerical summaries...* brings up the dialog box shown in Figure 11. Only numerical variables are shown in the variable list in this dialog; the factor `region` is missing, because it is not sensible to compute numerical summaries for a factor. Clicking on `infant.mortality`, and then clicking *OK*, produces the following output (in the output window):[10]

```
> numSummary(Nations[,"infant.mortality"], statistics=c("mean", "sd", "quantiles"))
     mean       sd 0% 25% 50% 75% 100%   n NA
 43.47761 38.75604  2  12  30  66  169 201  6
```

By default, the R command that is executed print sout the mean and standard deviation (`sd`) of the variable, along with quantiles (percentiles) corresponding to the minimum, the first quartile, the median, the third quartile, and the maximum; `n` is the number of valid obserations, and `NA` the number of missing values.

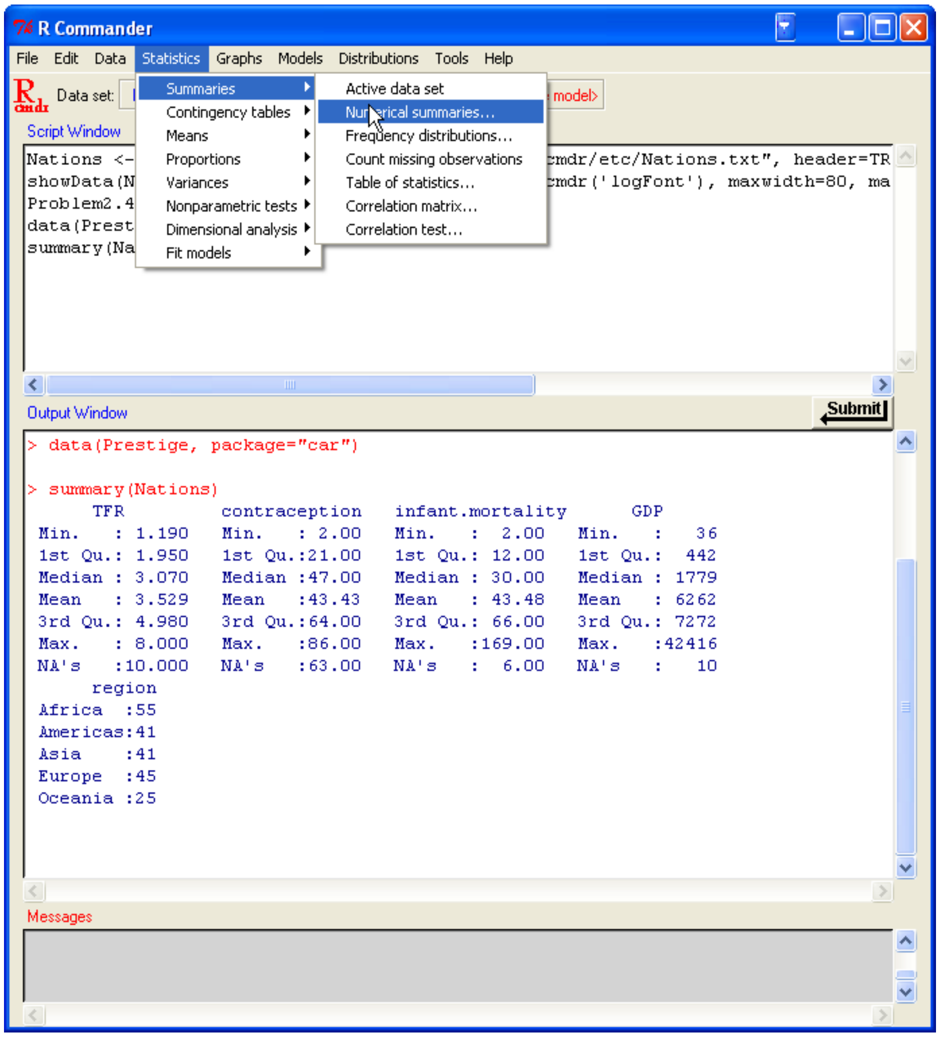
As is typical of R Commander dialogs, the *Numerical Summaries* dialog box in Figure 11 includes *OK*, *Cancel*, and *Help* buttons. The *Help* button leads to a help page either for the dialog itself or (as here) for an R function that the dialog invokes.

The *Numerical Summaries* dialog box also makes provision for computing summaries within groups defined by the levels of a factor. Clicking on the *Summarize by groups...* button brings up the *Groups* dialog, as shown in Figure 12. Because there is only one factor in the `Nations` data set, only the variable `region` appears in the variable list; selecting this variable and clicking *OK* changes the *Summarize by groups...* button to *Summarize by region* (see Figure 13); clicking *OK* produces the following results:

```
> numSummary(Nations[,"infant.mortality"],
      groups=Nations$region, statistics=c("mean", "sd", "quantiles"))
             mean        sd 0%   25%  50%    75% 100%  n NA
Africa   85.27273 35.188095  7 61.00 85.0 111.00  169 55  0
Americas 25.60000 17.439713  6 12.00 21.5  36.00   82 40  1
Asia     45.65854 32.980001  5 22.00 37.0  72.00  154 41  0
Europe   11.85366  7.122363  5  6.00  8.0  16.00   32 41  4
Oceania  27.79167 29.622229  2  9.25 20.0  35.75  135 24  1
```

Several other R Commander dialogs allow you to select a grouping variable in this manner.

[10]To select a single variable in a variable-list box, simply left-click on its name. In some contexts, you will have to (or want to) select more than one variable. In these cases, the usual Windows conventions apply: Left-clicking on a variable selects it and de-selects any variables that have previously been selected; *Shift-left-click* extends the selection; and *Ctrl-left-click* toggles the selection for an individual variable.

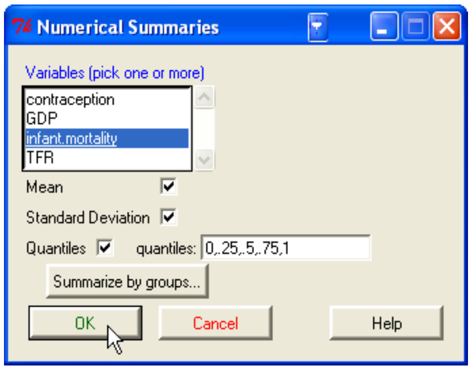


```
Nations <-                                    cmdr/etc/Nations.txt", header=TR
showData(N                                    cmdr('logFont'), maxwidth=80, ma
Problem2.4
data(Prest
summary(Na
```

```
> data(Prestige, package="car")

> summary(Nations)
      TFR          contraception    infant.mortality      GDP
 Min.   : 1.190   Min.   : 2.00   Min.   :  2.00   Min.   :   36
 1st Qu.: 1.950   1st Qu.:21.00   1st Qu.: 12.00   1st Qu.:  442
 Median : 3.070   Median :47.00   Median : 30.00   Median : 1779
 Mean   : 3.529   Mean   :43.43   Mean   : 43.48   Mean   : 6262
 3rd Qu.: 4.980   3rd Qu.:64.00   3rd Qu.: 66.00   3rd Qu.: 7272
 Max.   : 8.000   Max.   :86.00   Max.   :169.00   Max.   :42416
 NA's   :10.000   NA's   :63.00   NA's   :  6.00   NA's   :   10
      region
 Africa  :55
 Americas:41
 Asia    :41
 Europe  :45
 Oceania :25
```

Figure 10: Getting variable summaries for the active data set.



Mean ☑
Standard Deviation ☑
Quantiles ☑ quantiles: 0,.25,.5,.75,1

Figure 11: The *Numerical Summaries* dialog box.

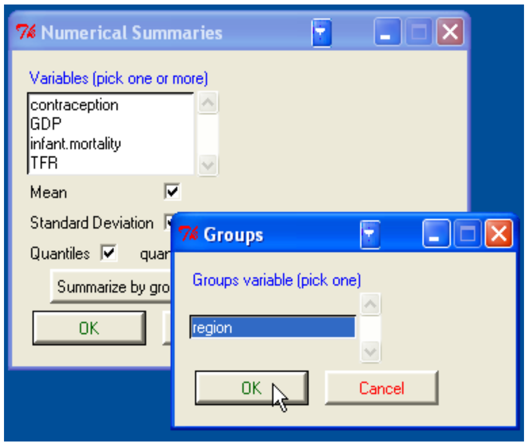


Figure 12: Selecting a grouping variable in the *Groups* dialog box.

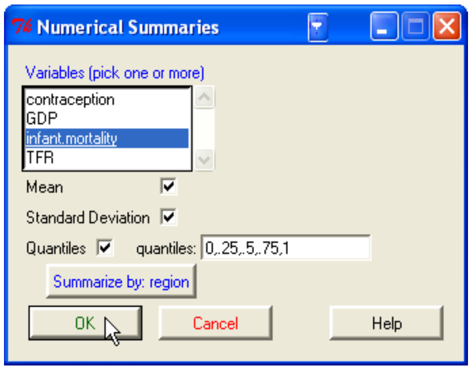


Figure 13: The *Numerical Summaries* dialog box after a grouping variable has been selected.

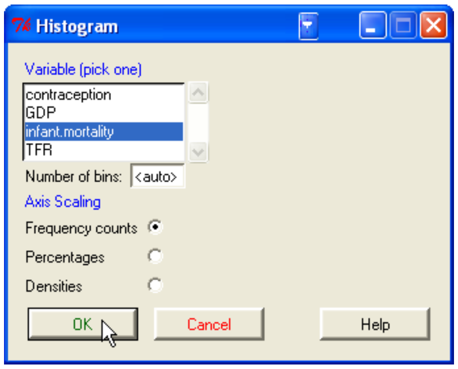


Figure 14: The *Histogram* dialog.

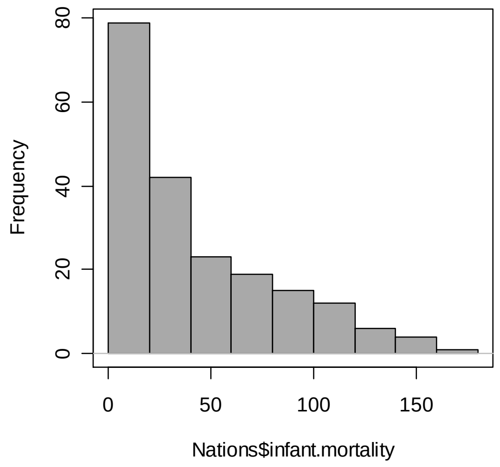
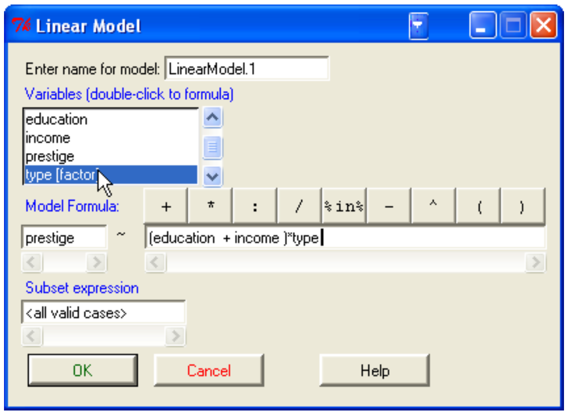


Figure 15: A graphics window containing the histogram for infant mortality.

Making graphs with the R Commander is also straightforward. For example, selecting *Graphs* ⟶ *Histogram...* from the *R Commander* menus brings up the *Histogram* dialog box in Figure 14; and clicking on `infant.mortality` followed by *OK*, opens a *Graphics Device* window with the histogram shown in Figure 15.

If you make several graphs in a session, then only the most recent normally appears in the *Graphics Device* window. You can recall previous graphs using the *Page Up* and *Page Down* keys on your keyboard.[11]

[11] At start-up, the R Commander turns on the graph history mechanism; this feature is available only in Windows systems. Dynamic three-dimensional scatterplots created by *Graphs* ⟶ *3D graph* ⟶ *3D scatterplot...* appear in a special *RGL device* window; likewise, effect displays created for statistical models (Fox, 2003) via *Models* ⟶ *Graphs* ⟶ *Effect plots* appear in individual graphics-device windows.



Enter name for model: LinearModel.1

prestige ~ (education + income)*type

<all valid cases>

Figure 16: The *Linear Model* dialog box.

4 Statistical Models

Several kinds of statistical models can be fit in the R Commander using menu items under *Statistics* ⟶ *Fit models*: linear models (by both *Linear regression* and *Linear model*), generalized linear models, multinomial logit models, and proportional-odds models [the latter two from Venables and Ripley's (2002) `nnet` and `MASS` packages, respectively]. Although the resulting dialog boxes differ in certain details (for example, the generalized linear model dialog makes provision for selecting a distributional family and corresponding link function), they share a common general structure, as illustrated in the *Linear Model* dialog in Figure 16.[12]

- Double-clicking on a variable in the variable-list box copies it to the model formula — to the left-hand side of the formula, if it is empty, otherwise to the right-hand side (with a preceding + sign if the context requires it). Note that factors (categorical variables) are parenthetically labelled as such in the variable list.

- The row of buttons above the formula can be used to enter operators and parentheses into the right-hand size of the formula.

- You can also type directly into the formula fields, and indeed have to do so, for example, to put a term such as log(income) into the formula.

- The name of the model, here `LinearModel.1`, is automatically generated, but you can substitute any valid R name.

- You can type an R expression into the box labelled *Subset expression*; if supplied, this is passed to the `subset` argument of the `lm` function, and is used to fit the model to a subset of the observations in the data set. One form of subset expression is a logical expression that evaluates to `TRUE` or `FALSE` for each observation, such as `type != "prof"` (which would select all non-professional occupations from the `Prestige` data set).

[12] An exception is the *Linear Regression* dialog in which the response variable and explanatory variables are simply selected by name from list boxes containing the numeric variables in the current data set. The explanation below assumes familiarity with R model formulas; see, for example, the *Introduction to R* manual that comes with R, which may be accessed from the *Help* menu in the *R Console*.

Clicking the *OK* button produces the following output (in the output window), and makes `LinearModel.1` the active model, with its name displayed in the *Model* button:

```
> LinearModel.1 <- lm(prestige ~ (education  + income )*type , data=Prestige)

> summary(LinearModel.1)

Call:
lm(formula = prestige ~ (education + income) * type, data = Prestige)

Residuals:
    Min      1Q  Median      3Q     Max
-13.462  -4.225   1.346   3.826  19.631

Coefficients:
                         Estimate Std. Error t value Pr(>|t|)
(Intercept)             2.276e+00  7.057e+00   0.323   0.7478
education               1.713e+00  9.572e-01   1.790   0.0769 .
income                  3.522e-03  5.563e-04   6.332 9.62e-09 ***
type[T.prof]            1.535e+01  1.372e+01   1.119   0.2660
type[T.wc]             -3.354e+01  1.765e+01  -1.900   0.0607 .
education:type[T.prof]  1.388e+00  1.289e+00   1.077   0.2844
education:type[T.wc]    4.291e+00  1.757e+00   2.442   0.0166 *
income:type[T.prof]    -2.903e-03  5.989e-04  -4.847 5.28e-06 ***
income:type[T.wc]      -2.072e-03  8.940e-04  -2.318   0.0228 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 6.318 on 89 degrees of freedom
Multiple R-Squared: 0.8747, Adjusted R-squared: 0.8634
F-statistic: 77.64 on 8 and 89 DF,  p-value: < 2.2e-16
```

Operations on the active model may be selected from the *Models* menu. For example, *Models* ⟶ *Hypothesis tests* ⟶ *Anova table* produces the following output:

```
> Anova(LinearModel.1)
Anova Table (Type II tests)

Response: prestige
               Sum Sq Df F value    Pr(>F)
education      1068.0  1 26.7532 1.413e-06 ***
income         1131.9  1 28.3544 7.511e-07 ***
type            591.2  2  7.4044  0.001060 **
education:type  238.4  2  2.9859  0.055574 .
income:type     951.8  2 11.9210 2.588e-05 ***
Residuals      3552.9 89
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

5 Odds and Ends

5.1 Saving and Printing Output

You can save text output directly from the *File* menu in the *R Commander*; likewise you can save or print a graph from the *File* menu in an R *Graphics Device* window. It is generally more convenient, however, to collect the text output and graphs that you want to keep in a word-processor document. In this manner, you can intersperse R output with your typed notes and explanations.

Open a word processor such as Word, or even Windows WordPad. To copy text from the output window, block the text with the mouse, select *Copy* from the *Edit* menu (or press the key combination *Ctrl-c*, or right-click in the window and select *Copy* from the context menu), and then paste the text into the word-processor window via *Edit* ⟶ *Paste* (or *Ctrl-v*), as you would for any Windows application. One point worth mentioning is that you should use a mono-spaced ("`typewriter`") font, such as *Courier New*, for text output from R; otherwise the output will not line up neatly.

Likewise to copy a graph, select *File* ⟶ *Copy to the clipboard* ⟶ *as a Metafile* from the R *Graphics Device* menus; then paste the graph into the word-processor document via *Edit* ⟶ *Paste* (or *Ctrl-v*). Alternatively, you can use *Ctrl-w* to copy the graph from the R *Graphics Device*, or right-click on the graph to bring up a context menu, from which you can select *Copy as metafile*.[13] At the end of your R session, you can save or print the document that you have created, providing an annotated record of your work.

Alternative routes to saving text and graphical output may be found respectively under the R Commander *File* and *Graphs* ⟶ *Save graph to file* menus.

5.2 Terminating the R Session

There are several ways to terminate your session. For example, you can select *File* ⟶ *Exit* ⟶ *From Commander and R* from the *R Commander* menus. You will be asked to confirm, and then asked whether you want to save the contents of the script and output windows. Likewise, you can select *File* ⟶ *Exit* from the *R Console*; in this case, you will be asked whether you want to save the R workspace (i.e., the data that R keeps in memory); you would normally answer *No*.

5.3 Entering Commands in the Script Window

The script window provides a simple facility for editing, entering, and executing commands. Commands generated by the R Commander appear in the script window, and you can type and edit commands in the window more or less as in any editor. The R Commander does not provide a true "console" for R, however, and the script window has some limitations:

- Commands that extend over more than one line should have the second and subsequent lines indented by one or more spaces or tabs; all lines of a multiline command must be submitted simultaneously for execution.
- Commands that include an assignment arrow (`<-`) will not generate printed output, even if such output would normally appear had the command been entered in the *R Console* [the command `print(x <- 10)`, for example]. On the other hand, assignments made with the equals sign (`=`) produce printed output even when they normally would not (e.g., `x = 10`).
- Commands that produce normally invisible output will occasionally cause output to be printed in the output window. This behaviour can be modified by editing the entries of the `log-exceptions.txt` file in the R Commander's `etc` directory.
- Blocks of commands enclosed by braces, i.e., `{}`, are not handled properly unless each command is terminated with a semicolon (`;`). This is poor R style, and implies that the script window is of limited use as a programming editor. For serious R programming, it would be preferable to use the script editor provided by the Windows version of R itself, or — even better — a programming editor.

[13]As you will see when you examine these menus, you can save graphs in a variety of formats, and to files as well as to the clipboard. The procedure suggested here is straightforward, however, and generally results in high-quality graphs. Once again, this description applies to Windows systems.

References

Fox, J. (2003). Effect displays in R for generalised linear models. *Journal of Statistical Software*, 8(15):1–27.

Fox, J. (2005). The R Commander: A basic-statistics graphical user interface to R. *Journal of Statistical Software*, 19(9):1–42.

Moore, D. S. (2000). *The Basic Practice of Statistics, Second Edition.* Freeman, New York.

Venables, W. N. and Ripley, B. D. (2002). *Modern Applied Statistics with S, Fourth Edition.* Springer, New York.