

Biomass Experiment

>library("Rcmdr")

Tools ▶ Load Rcmdr plug-in(s)... ▶ RcmdrPlugin.DoE

Design ▶ Create designRegular (Fractional) Factorial...

Create regular 2-level design ...

Base Settings | Factor Details | Export

Name of new design: Tab Help

Size and randomization

Number of runs: Specify nruns

Number of factors:

Number of center points:

Number of blocks: blocks may be aliased with 2fis

Replications: Repeat only

You normally do not need to change randomization settings

Seed for randomization: Randomization

Design properties

Minimum resolution: Show available designs

MA (Maximum resolution and minimum aberration)

MaxC2 (Maximum number of clear 2fis)

Show best 10 designs for 5 factors in 8 runs
The menu remains open, fetch it back after looking at designs

OK Cancel Help Activate Special Choices

Store form Load form Reset form

Requested information

You must CLOSE this window for continuing work with the design dialogue.

		number of runs									
		8	16	32	64	128	256	512	1024	2048	4096
		<i>only the MA design</i>									
number of factors	3	full									
	4	IV	full								
	5	III	V	full							
	6	III	IV	VI	full						
	7	III	IV	IV	VII	full					
	8		IV	IV	V	VIII	full				
	9		III	IV	IV	VI	IX	full			
	10		III	IV	IV	V	VI	X	full		
	11		III	IV	IV	V	VI	VII	XI	full	
	12		III	IV	IV	IV	VI	VI	VIII	XII	full
	13		III	IV	IV	IV	V	VI	VII	VIII	XIII
	14		III	IV	IV	IV	V	VI	VII	VIII	IX
	15		III	IV	IV	IV	V	VI	VII	VIII	VIII
	16			IV	IV	IV	V	VI	VI	VIII	VIII
	17			III	IV	IV	V	VI	VI	VII	VIII
	18			III	IV	IV		VI	VI	VII	VIII
	19			III	IV	IV		V	VI	VII	VIII
	20			III	IV	IV		V	VI	VII	VIII
	21			III	IV	IV		V	VI	VII	VIII
	22			III	IV	IV		V	VI	VII	VIII
	23			III	IV	IV		V	VI	VII	VIII
	24			III	IV	IV			VI		VIII

Designs in 32 runs are available for up to 31 factors (resolution III).
Designs in 128 runs are available for up to 64 Factors (resolution IV) and 65 to 127 Factors (resolution III).

Create regular 2-level design ...

Base Settings | **Factor Details** | Export

Tab Help

Default levels

Common factor levels

First Level: -1 Second Level: 1

Modify factor details for selected factor

Select	Factor name	First level	Second level	Comment or label (for html export only)
A	A	-1	1	

Factor Details

▲	A	A	-1	1	
▼	B	B	-1	1	
▼	C	C	-1	1	
▼	D	D	-1	1	
▼	E	E	-1	1	

Move Down
Move Up

Store form
Load form
Reset form

OK Cancel Help Activate Special Choices

Create regular 2-level design ...

Base Settings | **Factor Details** | **Export**

Current design to be saved: Design.1 Tab Help

(How to) Export ?

no export
 all file types
 rda only
 html and rda
 csv and rda

Decimal Separator ?

default
 .
 ,

Storage Directory

C:/Documents and Settings/Administrator/My Documents Change directory

Export file names: name below with appropriate endings (html or csv, and rda)

Design.1

Replace file(s), if exists

Store form
Load form
Reset form

OK Cancel Help Activate Special Choices

The screenshot shows the R Commander interface. The menu bar includes File, Edit, Data, Statistics, Graphs, Models, Distributions, Design, Tools, and Help. The 'Data set' is 'Design.1' and the 'Model' is '<No active model>'. The 'Script Window' contains the following R code:

```
Design.1 <- FrF2(nruns= 8 ,nfactors= 5 , blocks= 1 , alias.block.2fis =
  FALSE , ncenter= 0 , MaxC2 = FALSE , resolution = NULL ,replications= 1 ,
  repeat.only= FALSE ,randomize= TRUE ,seed= 8868 , factor.names=list( A=c(-1,
  1),B=c(-1,1),C=c(-1,1),D=c(-1,1),E=c(-1,1) ) )
## creator element of design.info will be different, when using the command line
```

The 'Output Window' shows the execution of the code:

```
> Design.1 <- FrF2(nruns= 8 ,nfactors= 5 , blocks= 1 , alias.block.2fis =
+   FALSE , ncenter= 0 , MaxC2 = FALSE , resolution = NULL ,replications= 1 ,
+   repeat.only= FALSE ,randomize= TRUE ,seed= 8868 , factor.names=list( A=c(-1,
+   1),B=c(-1,1),C=c(-1,1),D=c(-1,1),E=c(-1,1) ) )
> ## creator element of design.info will be different, when using the command li
```

The 'Messages' window displays a note: "NOTE: The dataset Design.1 has 8 rows and 5 columns."

Design ► Inspect Design ► Display Active Design

	A	B	C	D	E
1	1	-1	-1	-1	-1
2	-1	-1	-1	1	1
3	-1	1	1	-1	-1
4	-1	-1	1	1	-1
5	1	-1	1	-1	1
6	1	1	1	1	1
7	1	1	-1	1	-1
8	-1	1	-1	-1	1

The screenshot shows the R Commander window with the following content:

Script Window

```

Design.1 <- FrF2(nruns= 8 ,nfactors= 5 , blocks= 1 , alias.block.2fis =
  FALSE , ncenter= 0 , MaxC2 = FALSE , resolution = NULL ,replications= 1 ,
  repeat.only= FALSE ,randomize= TRUE ,seed= 8868 , factor.names=list( A=c(-1,
  1),B=c(-1,1),C=c(-1,1),D=c(-1,1),E=c(-1,1) ) )
## creator element of design.info will be different, when using the command line
showData(Design.1, placement='-20+200', font=getRcmdr('logFont'),
  maxwidth=80, maxheight=30)
print( Design.1 )

```

Output Window

```

+ repeat.only= FALSE ,randomize= TRUE ,seed= 8868 , factor.names=list( A=c(-1,
+ 1),B=c(-1,1),C=c(-1,1),D=c(-1,1),E=c(-1,1) ) )

> ## creator element of design.info will be different, when using the command li

> showData(Design.1, placement='-20+200', font=getRcmdr('logFont'),
+ maxwidth=80, maxheight=30)

> print( Design.1 )
  A B C D E
1  1 -1 -1 -1 -1
2 -1 -1 -1  1  1
3 -1  1  1 -1 -1
4 -1 -1  1  1 -1
5  1 -1  1 -1  1
6  1  1  1  1  1
7  1  1 -1  1 -1
8 -1  1 -1 -1  1
class=design, type= FrF2

```

Messages

The Messages window is currently empty.

Design ► Inspect Design ► Summarize design

The screenshot shows the "Summarize Design" dialog box with the following settings:

- Designs (pick one):** Design.1
- Additional output?:**
 - Also create plot ?
 - Also create table ?

Buttons: OK, Cancel, Help

R Commander File Edit Data Statistics Graphs Models Distributions Design Tools Help

Rcmdr Data set: **Design.1** Edit data set View data set Model: **<No active model>**

Script Window

```
FALSE , ncenter= 0 , MaxC2 = FALSE , resolution = NULL , replications= 1 ,
repeat.only= FALSE , randomize= TRUE , seed= 8868 , factor.names=list( A=c(-1,
1),B=c(-1,1),C=c(-1,1),D=c(-1,1),E=c(-1,1) ) )
## creator element of design.info will be different, when using the command line
showData(Design.1, placement='-20+200', font=getRcmdr('logFont'),
maxwidth=80, maxheight=30)
print( Design.1 )
summary( Design.1 )
table( Design.1 [,names(design.info( Design.1 )$factor.names)] )
```

Output Window **Submit**

```
> summary( Design.1 )
Experimental design of type FrF2
8 runs

Factor settings:
  A B C D E
1 -1 -1 -1 -1 -1
2  1  1  1  1  1

Alias structure:
$legend
[1] "A=A" "B=B" "C=C" "D=D" "E=E"

$main
[1] "A=BD=CE" "B=AD" "C=AE" "D=AB" "E=AC"

$fi2
[1] "BC=DE" "BE=CD"
```

Messages

Create regular 2-level design ...

Base Settings | Factor Details | Estimable Model | Export

Name of new design: Design.1 Tab Help

Size and randomization

Number of runs: 16 Specify nruns
 Number of factors: 8
 Number of center points: 0

Number of blocks: 1 blocks may be aliased with 2fis
 Replications: 1 Repeat only

You normally do not need to change randomization settings
 Seed for randomization: 8515 Randomization

Expert choices

None
 Specify Generators (generators option)
 Specify Design name (design option)

Type in generators: NULL
comma-separated column numbers of Yates matrix (e.g. 7, 13, 11)
 or comma-separated interaction columns (e.g. ABC, ACD, ABD)

Store form
Load form
Reset form

Design properties

Minimum resolution: III Show available designs

MA (Maximum resolution and minimum aberration)
 MaxC2 (Maximum number of clear 2fis)

Show best 10 designs for 8 factors in 16 runs
 The menu remains open,
 fetch it back after looking at designs

OK Cancel Help Activate Special Choices

Create regular 2-level design ...

Base Settings | Factor Details | Estimable Model | Export

Name of new design: Design.1 Tab Help

Size and randomization

Number of runs: 16 Specify nruns
 Number of factors: 8
 Number of center points: 0

Number of blocks: 1 blocks may be aliased with 2fis
 Replications: 1 Repeat only

You normally do not need to change randomization settings
 Seed for randomization: 6608 Randomization

Expert choices

None
 Specify Generators (generators option)
 Specify Design name (design option)

Type in generators: BCD,ACD,ABD,ABC
comma-separated column numbers of Yates matrix (e.g. 7, 13, 11)
 or comma-separated interaction columns (e.g. ABC, ACD, ABD)

Store form
Load form
Reset form

Design properties

Minimum resolution: III Show available designs

MA (Maximum resolution and minimum aberration)
 MaxC2 (Maximum number of clear 2fis)

Show best 10 designs for 8 factors in 16 runs
 The menu remains open,
 fetch it back after looking at designs

OK Cancel Help Activate Special Choices

R Commander File Edit Data Statistics Graphs Models Distributions Design Tools Help

Data set: **Design.1** Edit data set View data set Model: **<No active model>**

Script Window

```
fix(Design.1)
summary( Design.1 )
Design.1 <- FrF2(nruns = 16 ,nfactors = 8 , blocks = 1 , alias.block.2fis =
  FALSE , ncenter = 0 , hard= NULL , generators = c( "BCD","ACD","ABD","ABC"
  ) , design = NULL ,replications= 1 ,repeat.only= FALSE ,randomize= TRUE ,
  seed= 8515 , factor.names=list( A=c(-1,1),B=c(-1,1),C=c(-1,1),D=c(-1,1),
  E=c(-1,1),F=c(-1,1),G=c(-1,1),H=c(-1,1) ) , catlg = catlg )
## creator element of design.info will be different, when using the command line
summary( Design.1 )
```

Output Window **Submit**

```
Experimental design of type FrF2.generators
16 runs

Factor settings:
  A B C D E F G H
1 -1 -1 -1 -1 -1 -1 -1
2  1  1  1  1  1  1  1

Alias structure:
$legend
[1] "A=A" "B=B" "C=C" "D=D" "E=E" "F=F" "G=G" "H=H"

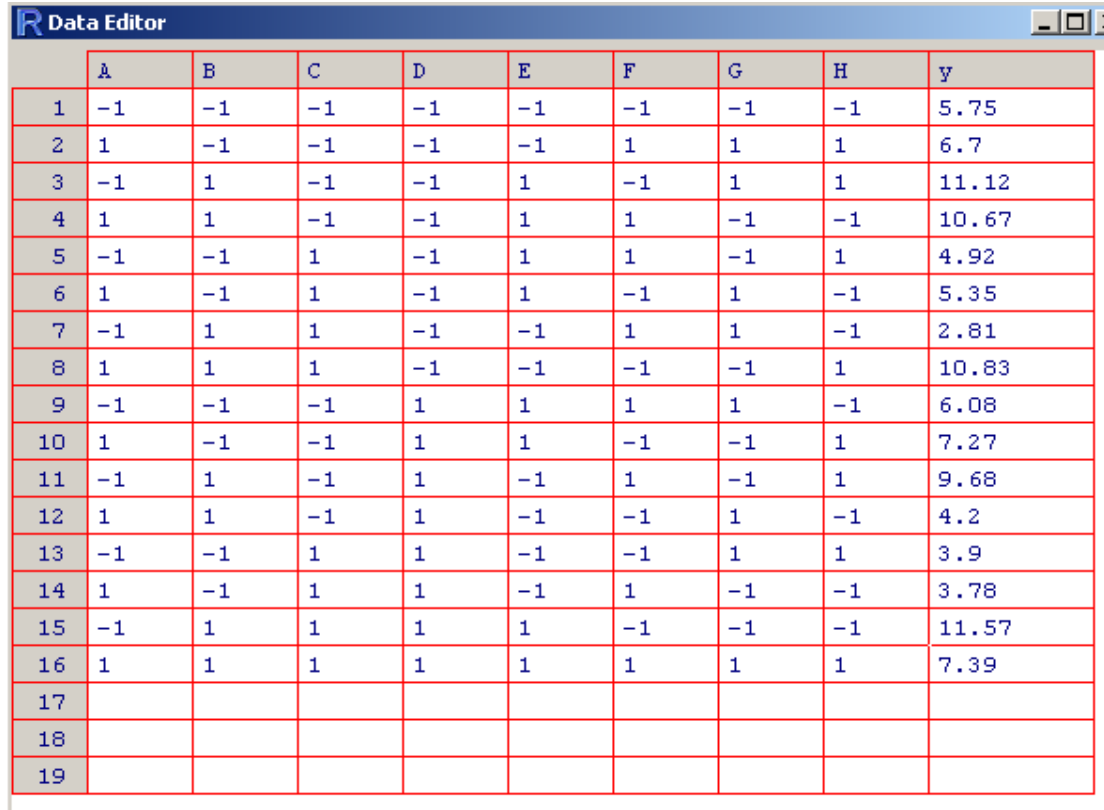
$main
character(0)

$fi2
[1] "AB=CH=DG=EF" "AC=BH=DF=EG" "AD=BG=CF=EH" "AE=BF=CG=DH" "AF=BE=CD=GH"
[6] "AG=BD=CE=FG" "AH=BC=DE=FG"
```

Messages

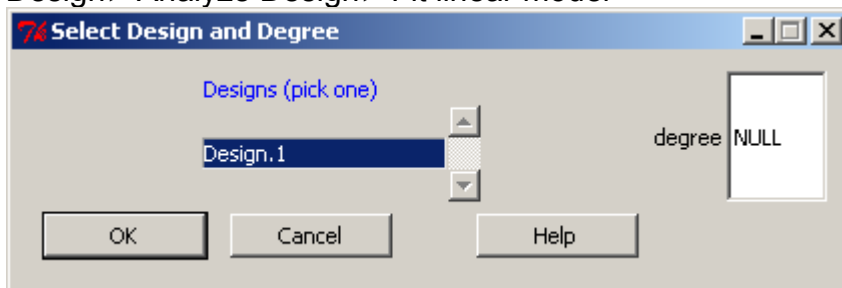
```
WARNING: design was generated with RcmdrPlugin.DoE
```

Edit data set



	A	B	C	D	E	F	G	H	y
1	-1	-1	-1	-1	-1	-1	-1	-1	5.75
2	1	-1	-1	-1	-1	1	1	1	6.7
3	-1	1	-1	-1	1	-1	1	1	11.12
4	1	1	-1	-1	1	1	-1	-1	10.67
5	-1	-1	1	-1	1	1	-1	1	4.92
6	1	-1	1	-1	1	-1	1	-1	5.35
7	-1	1	1	-1	-1	1	1	-1	2.81
8	1	1	1	-1	-1	-1	-1	1	10.83
9	-1	-1	-1	1	1	1	1	-1	6.08
10	1	-1	-1	1	1	-1	-1	1	7.27
11	-1	1	-1	1	-1	1	-1	1	9.68
12	1	1	-1	1	-1	-1	1	-1	4.2
13	-1	-1	1	1	-1	-1	1	1	3.9
14	1	-1	1	1	-1	1	-1	-1	3.78
15	-1	1	1	1	1	-1	-1	-1	11.57
16	1	1	1	1	1	1	1	1	7.39
17									
18									
19									

Design ► Analyze Design ► Fit linear model



R Commander File Edit Data Statistics Graphs Models Distributions Design Tools Help

Data set: **Design.1** Edit data set View data set Model: **LinearModel.1**

Script Window

```
FALSE , ncenter = 0 , hard= NULL , generators = c( "BCD","ACD","ABD","ABC"
) , design = NULL , replications= 1 , repeat.only= FALSE , randomize= FALSE ,
seed= 9440 , factor.names=list( A=c(-1,1),B=c(-1,1),C=c(-1,1),D=c(-1,1),
E=c(-1,1),F=c(-1,1),G=c(-1,1),H=c(-1,1) ) , catlg = catlg )
## creator element of design.info will be different, when using the command line
fix(Design.1)
DanielPlot(Design.1, code=TRUE, autolab=TRUE, alpha=0.1, half=TRUE)
LinearModel.1 <- lm(y ~ (A + B + C + D + E + F + G + H)^2, data=Design.1)
summary(LinearModel.1)
```

Output Window **Submit**

```
Coefficients: (21 not defined because of singularities)
      Estimate Std. Error t value Pr(>|t|)
(Intercept)  7.00125         NA      NA      NA
A1           0.02250         NA      NA      NA
B1           1.53250         NA      NA      NA
C1          -0.68250         NA      NA      NA
D1          -0.26750         NA      NA      NA
E1           1.04500         NA      NA      NA
F1          -0.49750         NA      NA      NA
G1          -1.05750         NA      NA      NA
H1           0.72500         NA      NA      NA
A1:B1       -0.28375         NA      NA      NA
A1:C1        0.49625         NA      NA      NA
A1:D1       -1.09625         NA      NA      NA
A1:E1       -0.39875         NA      NA      NA
A1:F1        0.60875         NA      NA      NA
A1:G1       -0.05625         NA      NA      NA
A1:H1        0.29875         NA      NA      NA
B1:C1                NA         NA      NA      NA
```

Messages

Design ► Analyze Design ► Effect lots for 2-level factors

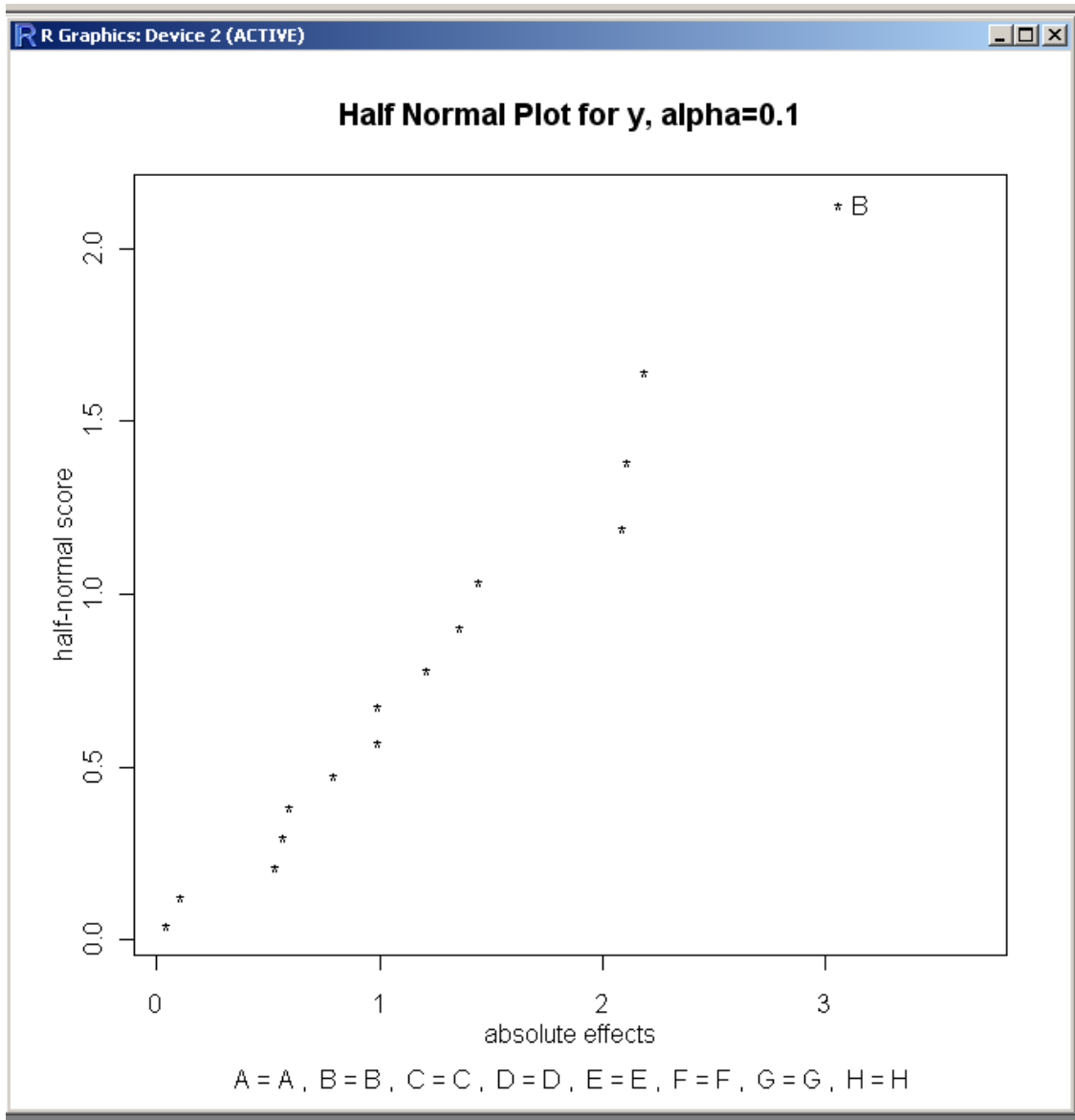
Effects plots for 2-level factors

Half normal plot ? Reset to defaults

Label effects with codes instead of names ?

Enter significance level for labelling:

Label significant effects only ?



Design ► Create designRegular (Fractional) Factorial...

Create regular 2-level design ...

Base Settings | Factor Details | Estimable Model | Export

Name of new design: Tab Help

Size and randomization

Number of runs: Specify nruns

Number of factors:

Number of center points:

Number of blocks: blocks may be aliased with 2fis

Replications: Repeat only

You normally do not need to change randomization settings

Seed for randomization: Randomization

Expert choices

None

Specify Generators (generators option)

Specify Design name (design option)

Design properties

Minimum resolution:

MA (Maximum resolution and minimum aberration)

MaxC2 (Maximum number of clear 2fis)

Show available designs

Show best 10 designs for 5 factors in 16 runs
The menu remains open, fetch it back after looking at designs

OK Cancel Help Activate Special Choices

Store form Load form Reset form

Create regular 2-level design ...

Base Settings | Factor Details | Estimable Model | Export

Default levels

Common factor levels

First Level: Second Level:

How many factors are hard to change?

The first factors are hard to change.

If necessary, modify the factor order on the Factor Details tab!

WARNING

Only specify this, if some factors are really hard to change.

The hard-to-change factors arrangement of experimental runs bears the risk of misjudging effects of these factors!

Modify factor details for selected factor

Select	Factor name	First level	Second level	Comment or label (for html export only)
E	H	-1	1	

Factor Details

▲	A	B	-1	1	
	B	C	-1	1	
	C	E	-1	1	
	D	G	-1	1	
▼	E	E	-1	1	

Move Down Move Up

OK Cancel Help Activate Special Choices

Store form Load form Reset form

Edit data set

	B	C	E	G	H	y	var7	var8
1	-1	-1	-1	-1	1	3.37		
2	1	-1	-1	-1	-1	3.55		
3	-1	1	-1	-1	-1	3.78		
4	1	1	-1	-1	1	2.81		
5	-1	-1	1	-1	-1	5.53		
6	1	-1	1	-1	1	10.43		
7	-1	1	1	-1	1	5.35		
8	1	1	1	-1	-1	11.57		
9	-1	-1	-1	1	-1	2.93		
10	1	-1	-1	1	1	7.23		
11	-1	1	-1	1	1	3.9		
12	1	1	-1	1	-1	10.83		
13	-1	-1	1	1	1	11.69		
14	1	-1	1	1	-1	10.59		
15	-1	1	1	1	-1	4.92		
16	1	1	1	1	1	7.39		
17								
18								
19								

Design ► Analyze Design ► Fit linear model

Select Design and Degree

Designs (pick one)

Design.1

degree NULL

OK Cancel Help

Linear model for experimental designs

Enter name for model: LinearModel.2

Variables (double-click to formula)

B [factor]
C [factor]
E [factor]
G [factor]

Model Formula:

y ~ (B + C + E + G + H)^2

OK Cancel Help

R Commander

File Edit Data Statistics Graphs Models Distributions Design Tools Help

Data set: **Design.1** Edit data set View data set Model: **LinearModel.2**

Script Window

```
Design.1 <- FrF2(nruns = 16 ,nfactors = 5 , blocks = 1 , alias.block.2fis =
  FALSE , ncenter = 0 , hard= NULL , generators = NULL , design = NULL ,
  replications= 1 ,repeat.only= FALSE ,randomize= FALSE ,seed= 20013 ,
  factor.names=list( B=c(-1,1),C=c(-1,1),E=c(-1,1),G=c(-1,1),H=c(-1,1) ) ,
  catlg = catlg )
## creator element of design.info will be different, when using the command line
fix(Design.1)
LinearModel.2 <- lm(y ~ (B + C + E + G + H)^2, data=Design.1)
summary(LinearModel.2)
```

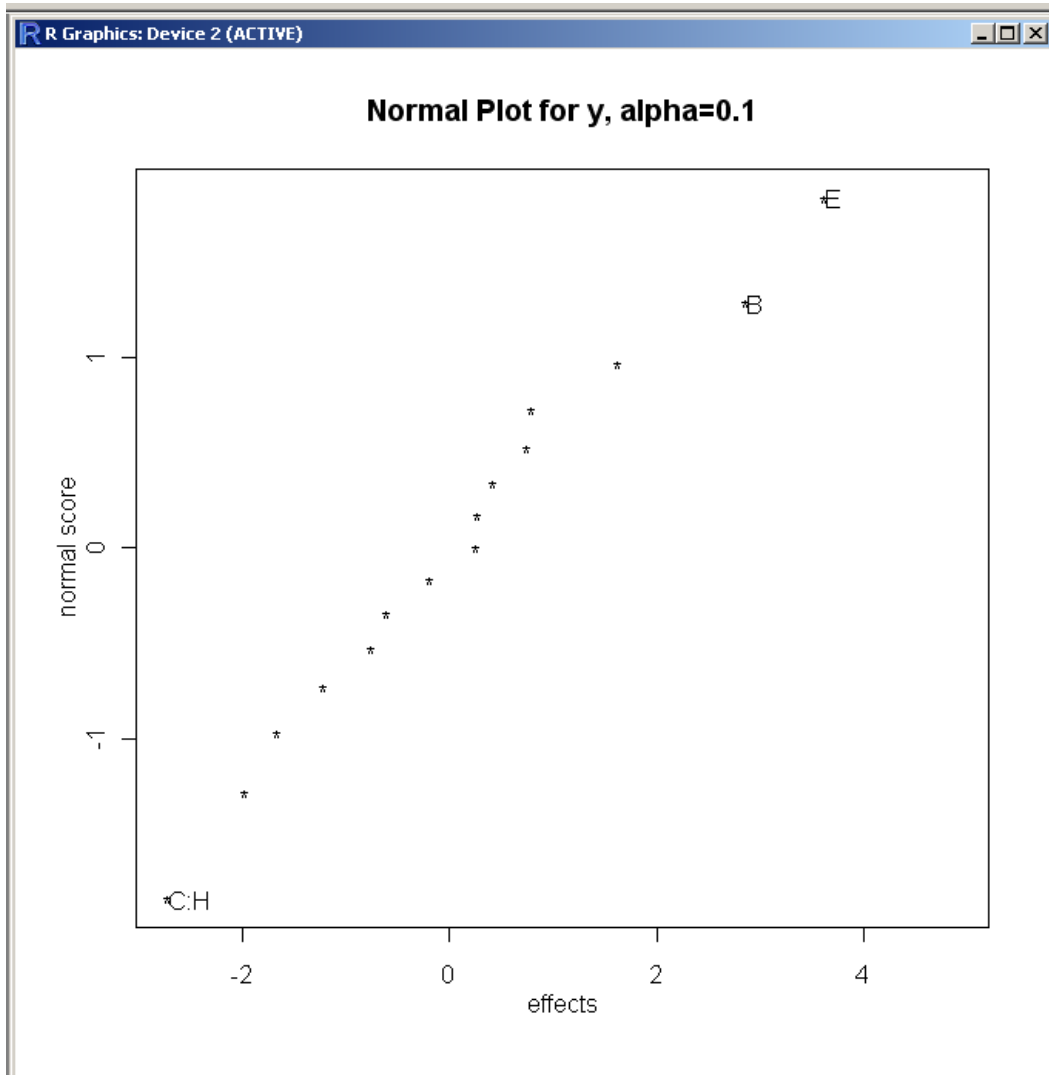
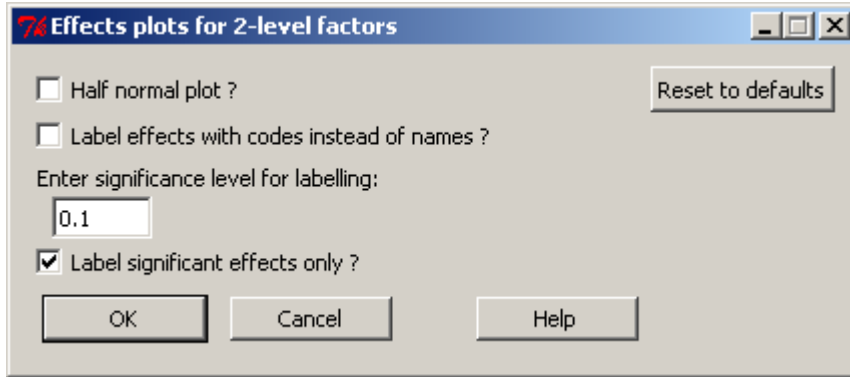
Output Window

Submit

```
Coefficients:
      Estimate Std. Error t value Pr(>|t|)
(Intercept)   6.61688      NA      NA      NA
B1             1.43312      NA      NA      NA
C1            -0.29812      NA      NA      NA
E1             1.81687      NA      NA      NA
G1             0.81812      NA      NA      NA
H1            -0.09563      NA      NA      NA
B1:C1          0.39813      NA      NA      NA
B1:E1          0.12812      NA      NA      NA
B1:G1          0.14188      NA      NA      NA
B1:H1         -0.98938      NA      NA      NA
C1:E1         -0.82812      NA      NA      NA
C1:G1         -0.37687      NA      NA      NA
C1:H1         -1.36062      NA      NA      NA
E1:G1         -0.60438      NA      NA      NA
E1:H1          0.37687      NA      NA      NA
G1:H1          0.21312      NA      NA      NA
```

Messages

Design ► Analyze Design ► Effect lots for 2-level factors



Design ► Analyze Design ► Interaction plots for 2-level factors

Interaction plots for 2-level factors

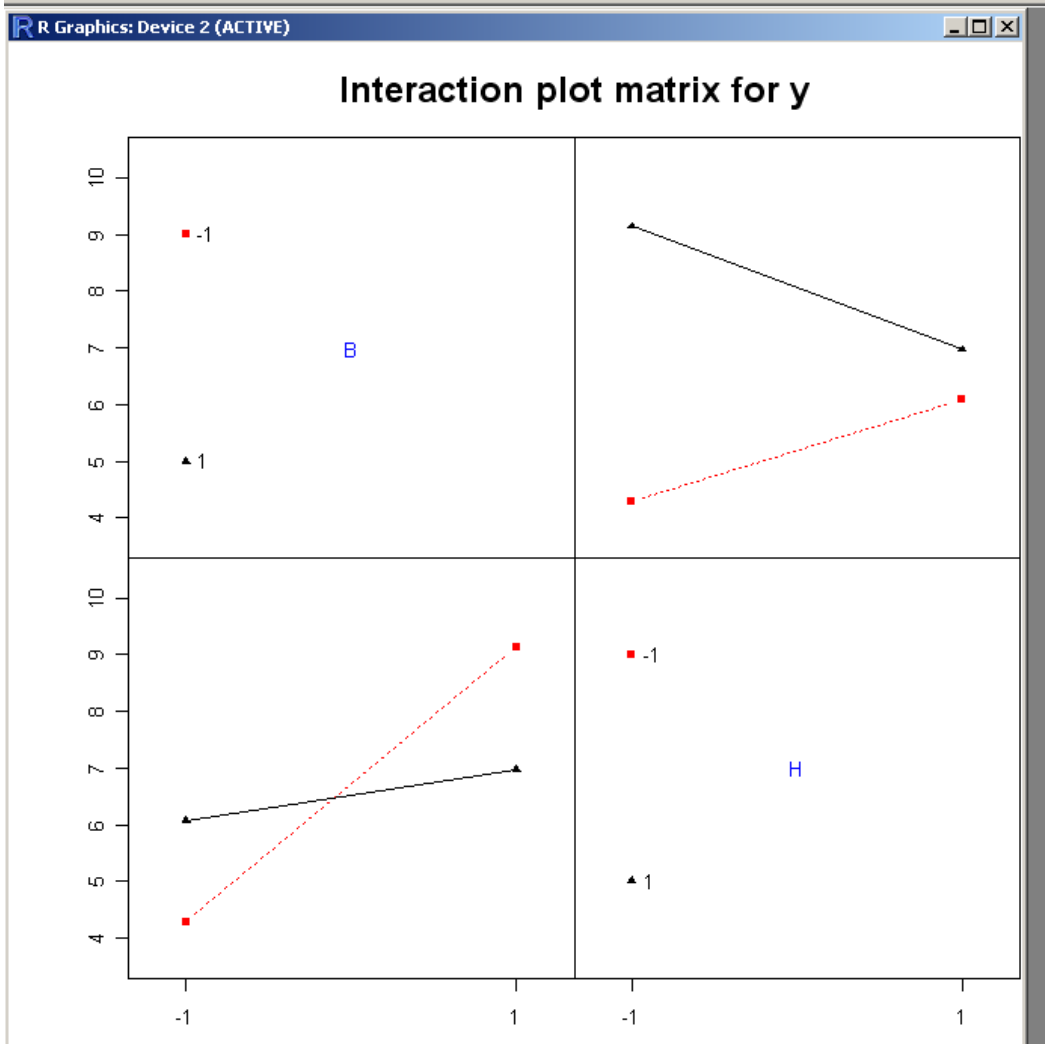
Factors (select at least two)
B
C
E
G

Length of abbreviations
1
2
3
4

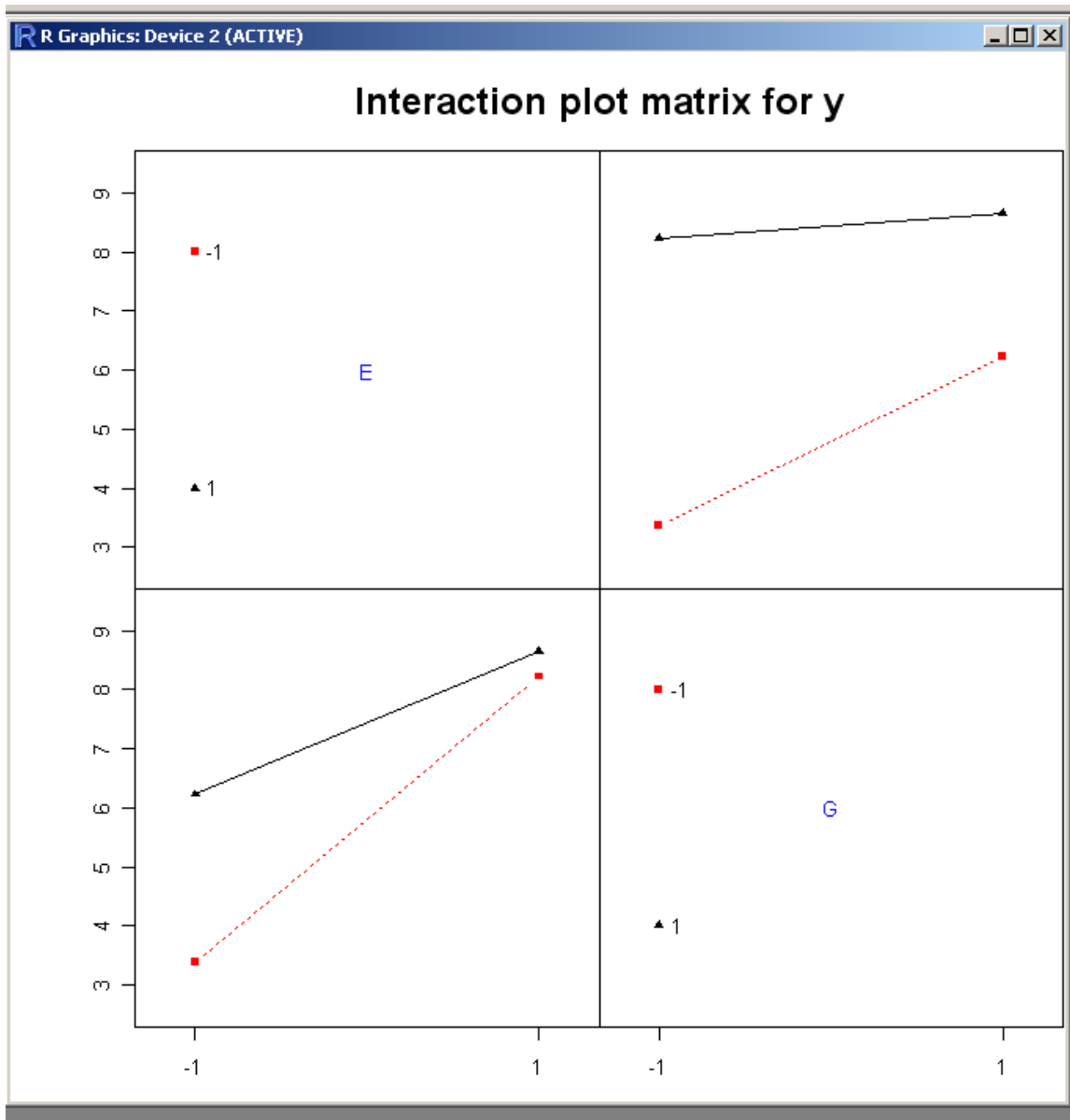
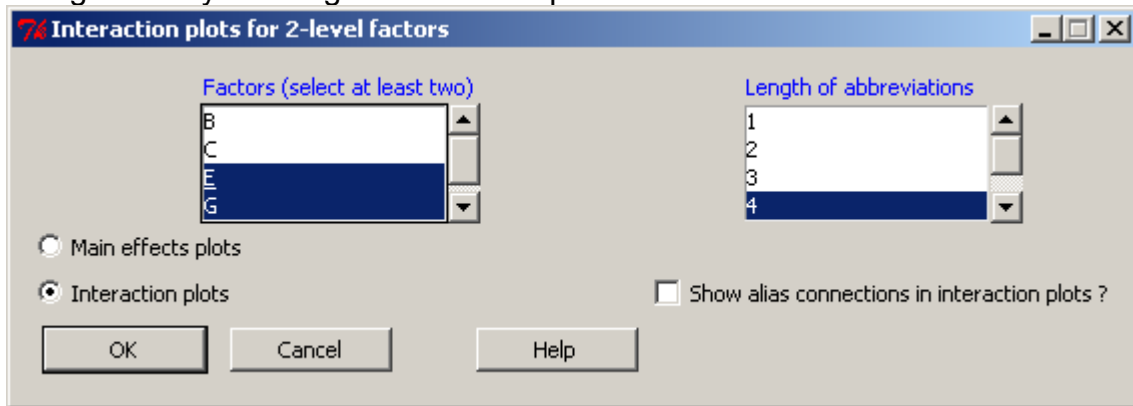
Main effects plots
 Interaction plots

Show alias connections in interaction plots ?

OK Cancel Help



Design ► Analyze Design ► Interaction plots for 2-level factors



Design ► Analyze Design ► Interaction plots for 2-level factors

