國立臺灣大學
National Taiwan University

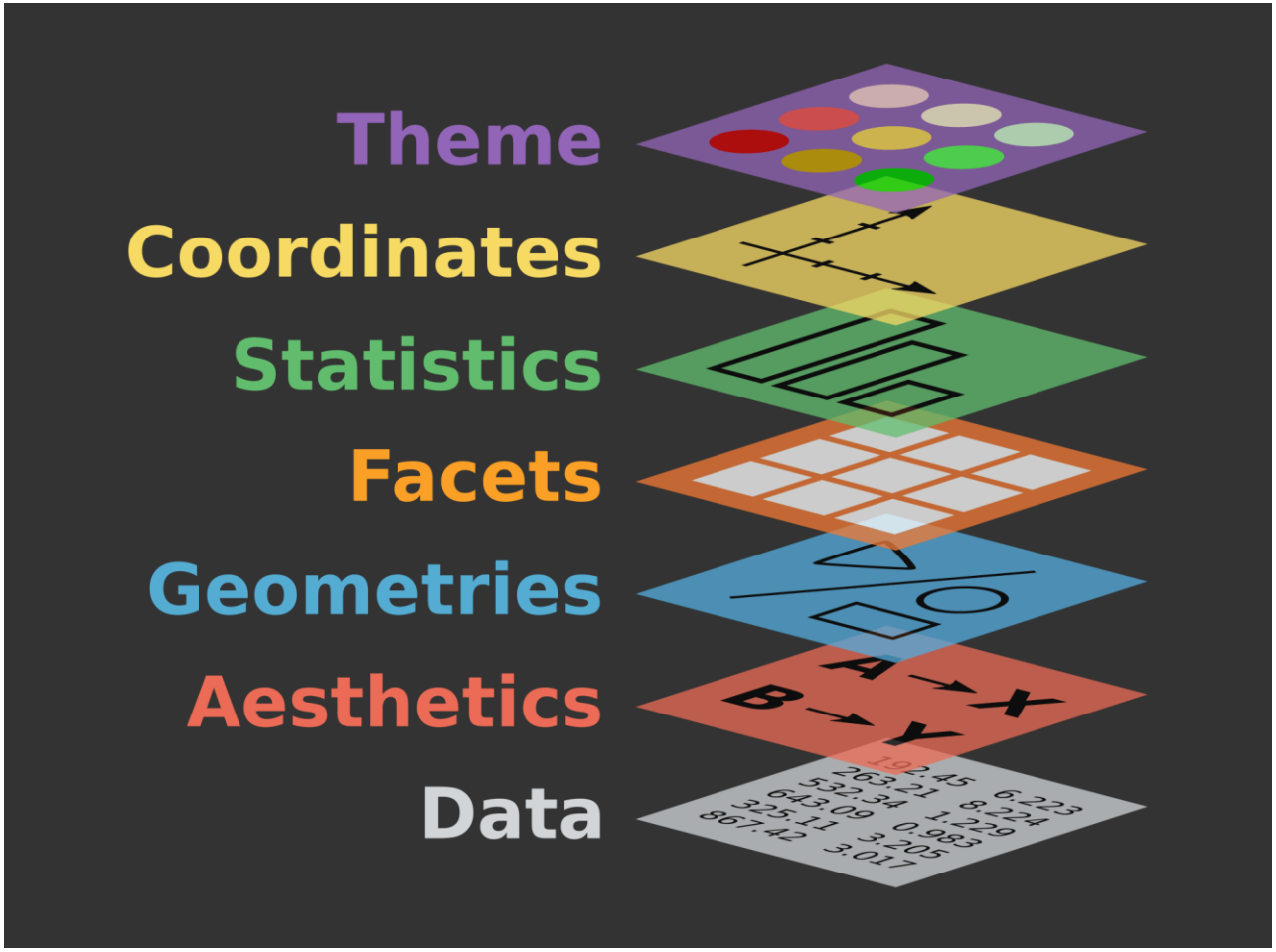
使用R語言進行資料分析
Using R for Data Analysis

國立臺灣大學共同教育中心
助理教授 蔡芸琤

Chapter 04

- 圖形

ggplot2 繪圖文法



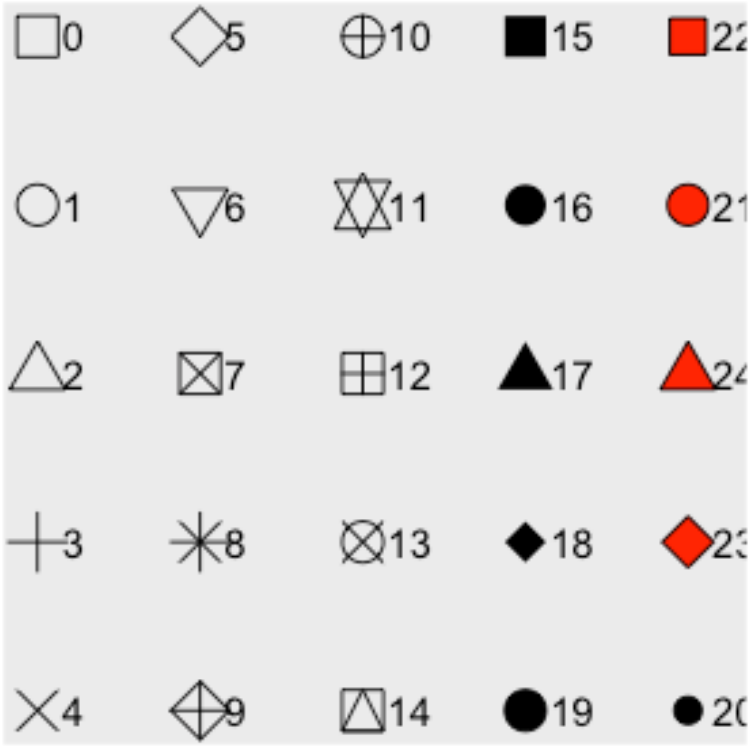
https://blog.gtwang.org/r/ggplot2-tutorial-basic-concept-and-qplot/
http://ggplot2.tidyverse.org/reference/

ggplot2 繪圖文法

- 資料來源（data）：指定原始資料來源的 data frame。
- 美學對應（aesthetic）：指定原始資料與圖形之間的對應關係，例如哪一個變數要當作 x 座標變數，而哪一個要當作 y 座標變數，還有資料繪圖時的樣式等。
- 幾何圖案（geometry）：要用什麼幾何圖形繪製資料，例如點、線條、多邊形等。

https://blog.gtwang.org/r/ggplot2-tutorial-basic-concept-and-qplot/

Aesthetic



shape

linetype

Geometry

- 直條圖：geom_bar()
- 線：geom_line()
- 點：geom_point()
- 階梯：geom_step()
- 路徑：geom_path()
- 盒形圖：geom_boxplot()

http://ggplot2.tidyverse.org/reference/

ggplot2 繪圖文法

- 繪圖面（facet）：指定如何將資料分散在多張子圖形中繪製，以利互相比較。
- 統計轉換（statistical transformation）：指定如何以將資料轉換為各種統計量。
- 座標系統（coordinate system）：指定繪圖時所使用的座標系統。
- 主題（theme）：控制資料以外的繪圖組件，例如座標軸、說明文字等。

https://blog.gtwang.org/r/ggplot2-tutorial-basic-concept-and-qplot/

未統計資料

RStudio Source Editor

raw

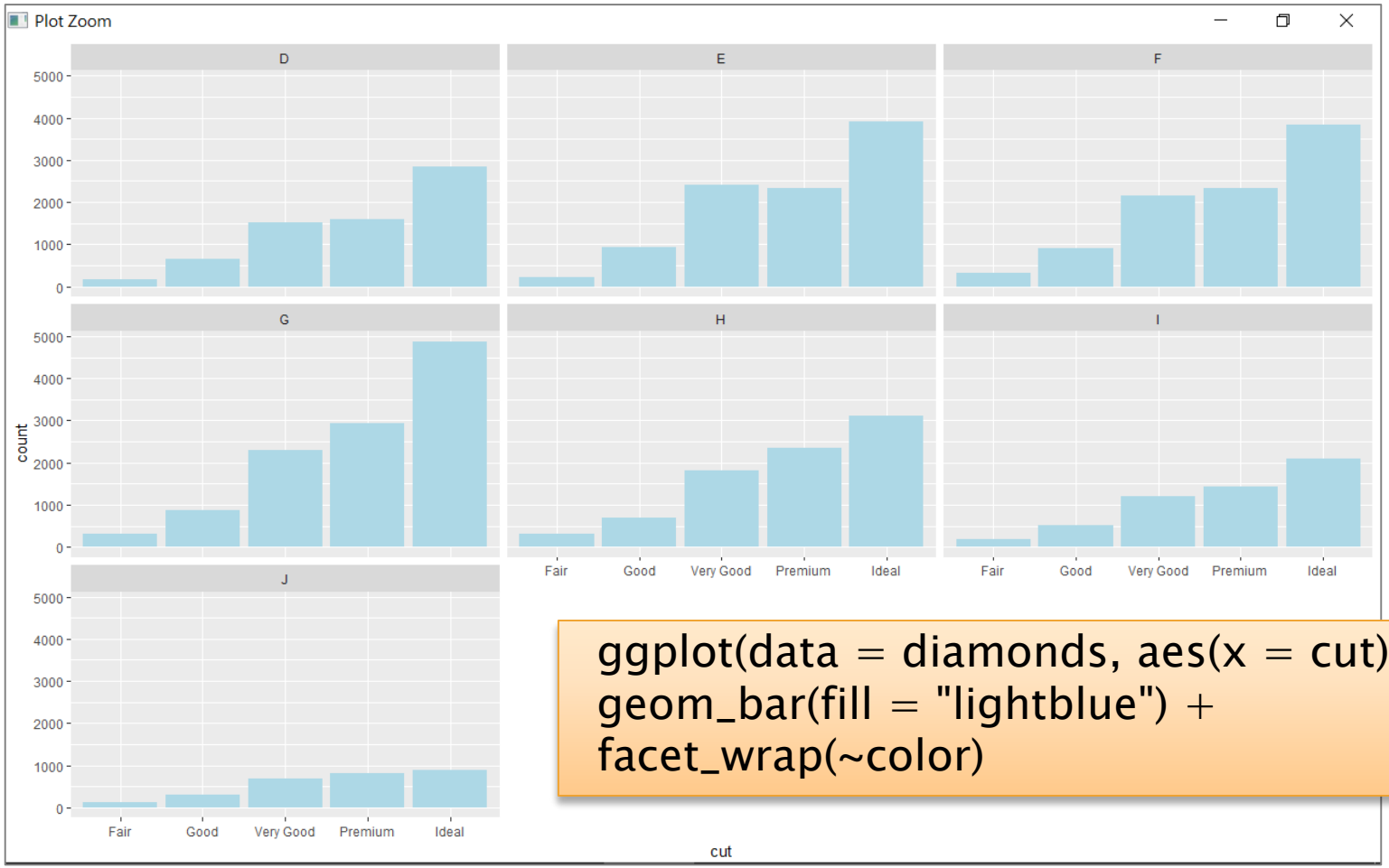
Filter

	carat	cut	color	clarity	depth	table	price	x	y	z
1	0.23	Ideal	E	SI2	61.5	55.0	326	3.95	3.98	2.43
2	0.21	Premium	E	SI1	59.8	61.0	326	3.89	3.84	2.31
3	0.23	Good	E	VS1	56.9	65.0	327	4.05	4.07	2.31
4	0.29	Premium	I	VS2	62.4	58.0	334	4.20	4.23	2.63
5	0.31	Good	J	SI2	63.3	58.0	335	4.34	4.35	2.75
6	0.24	Very Good	J	VVS2	62.8	57.0	336	3.94	3.96	2.48
7	0.24	Very Good	I	VVS1	62.3	57.0	336	3.95	3.98	2.47
8	0.26	Very Good	H	SI1	61.9	55.0	337	4.07	4.11	2.53
9	0.22	Fair	E	VS2	65.1	61.0	337	3.87	3.78	2.49
10	0.23	Very Good	H	VS1	59.4	61.0	338	4.00	4.05	2.39
11	0.30	Good	J	SI1	64.0	55.0	339	4.25	4.28	2.73
12	0.23	Ideal	J	VS1	62.8	56.0	340	3.93	3.90	2.46
13	0.22	Premium	F	SI1	60.4	61.0	342	3.88		
14	0.31	Ideal	J	SI2	62.2	54.0	344	4.35		
15	0.20	Premium	E	SI2	60.2	62.0	345	3.79		
16	0.32	Premium	E	I1	60.9	58.0	345	4.38	4.42	2.68
17	0.30	Ideal	I	SI2	62.0	54.0	348	4.31	4.34	2.68
18	0.30	Good	J	SI1	63.4	54.0	351	4.23	4.29	2.70
19	0.30	Good	J	SI1	63.8	56.0	351	4.23	4.26	2.71
20	0.30	Very Good	J	SI1	62.7	59.0	351	4.21	4.27	2.66
21	0.30	Good	I	SI2	63.3	56.0	351	4.26	4.30	2.71
22	0.23	Very Good	E	VS2	63.8	55.0	352	3.85	3.92	2.48
23	0.23	Very Good	H	VS1	61.0	57.0	353	3.94	3.96	2.41
24	0.31	Very Good	J	SI1	59.4	62.0	353	4.39	4.43	2.62
25	0.31	Very Good	J	SI1	58.1	62.0	353	4.44	4.47	2.59
26	0.23	Very Good	G	VVS2	60.4	58.0	354	3.97	4.01	2.41
27	0.24	Premium	I	VS1	62.5	57.0	355	3.97	3.94	2.47
28	0.30	Very Good	J	VS2	62.2	57.0	357	4.28	4.30	2.67
29	0.23	Very Good	D	VS2	60.5	61.0	357	3.96	3.97	2.40

diamonds

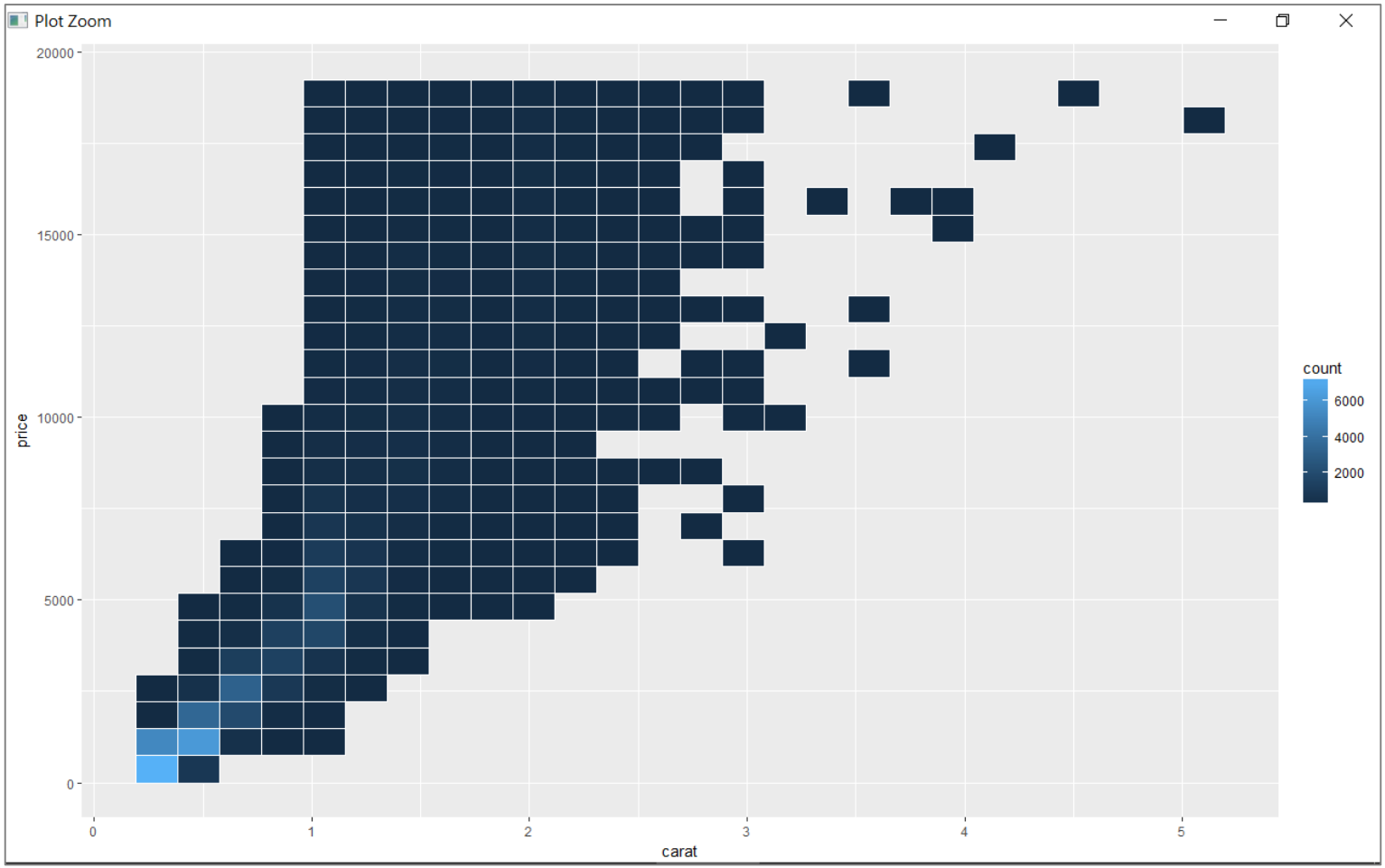
Showing 1 to 30 of 53,940 entries

繪圖面 (facet)



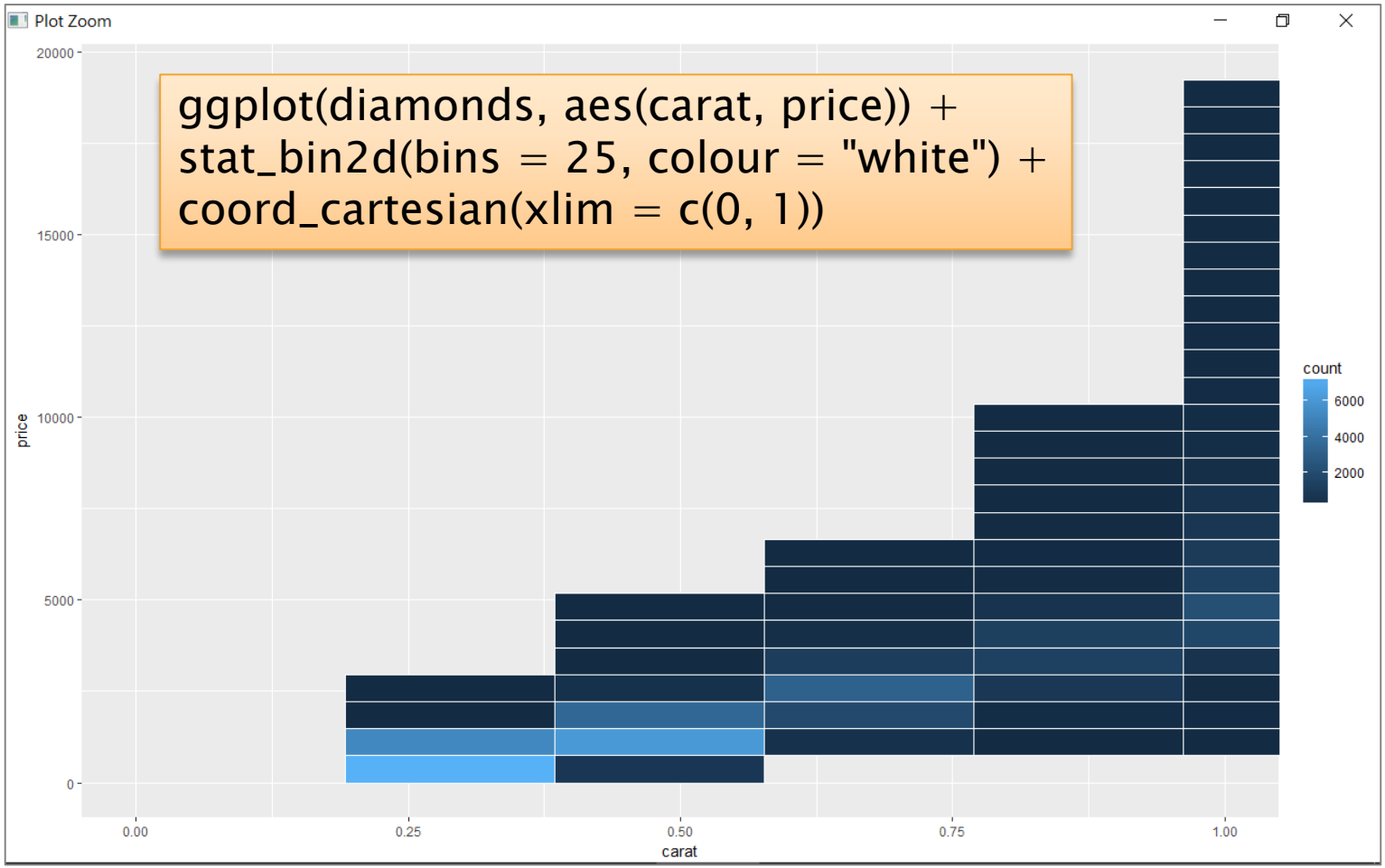

```
ggplot(data = diamonds, aes(x = cut)) +
geom_bar(fill = "lightblue") +
facet_wrap(~color)
```

Statistical Transformation




```
ggplot(diamonds, aes(carat, price)) +
stat_bin2d(bins = 25, colour = "white")
```

Coordinate System

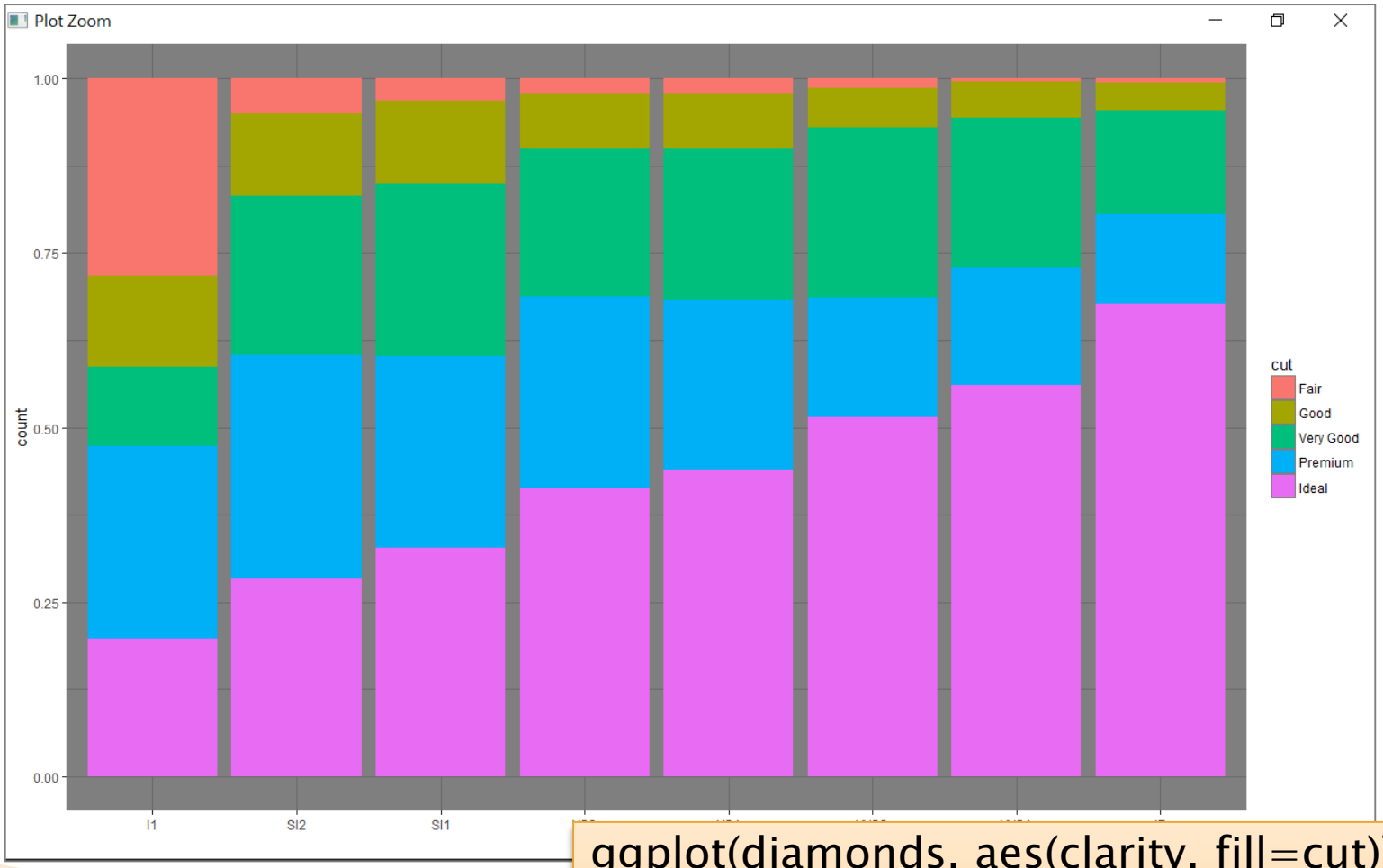


Theme

- theme_bw()
- theme_classic()
- theme_dark()
- theme_get()
- theme_gray()
- theme_grey()
- theme_light()
- theme_linedraw()
- theme_minimal()

https://www.r-bloggers.com/ggplot2-themes-examples/

Theme

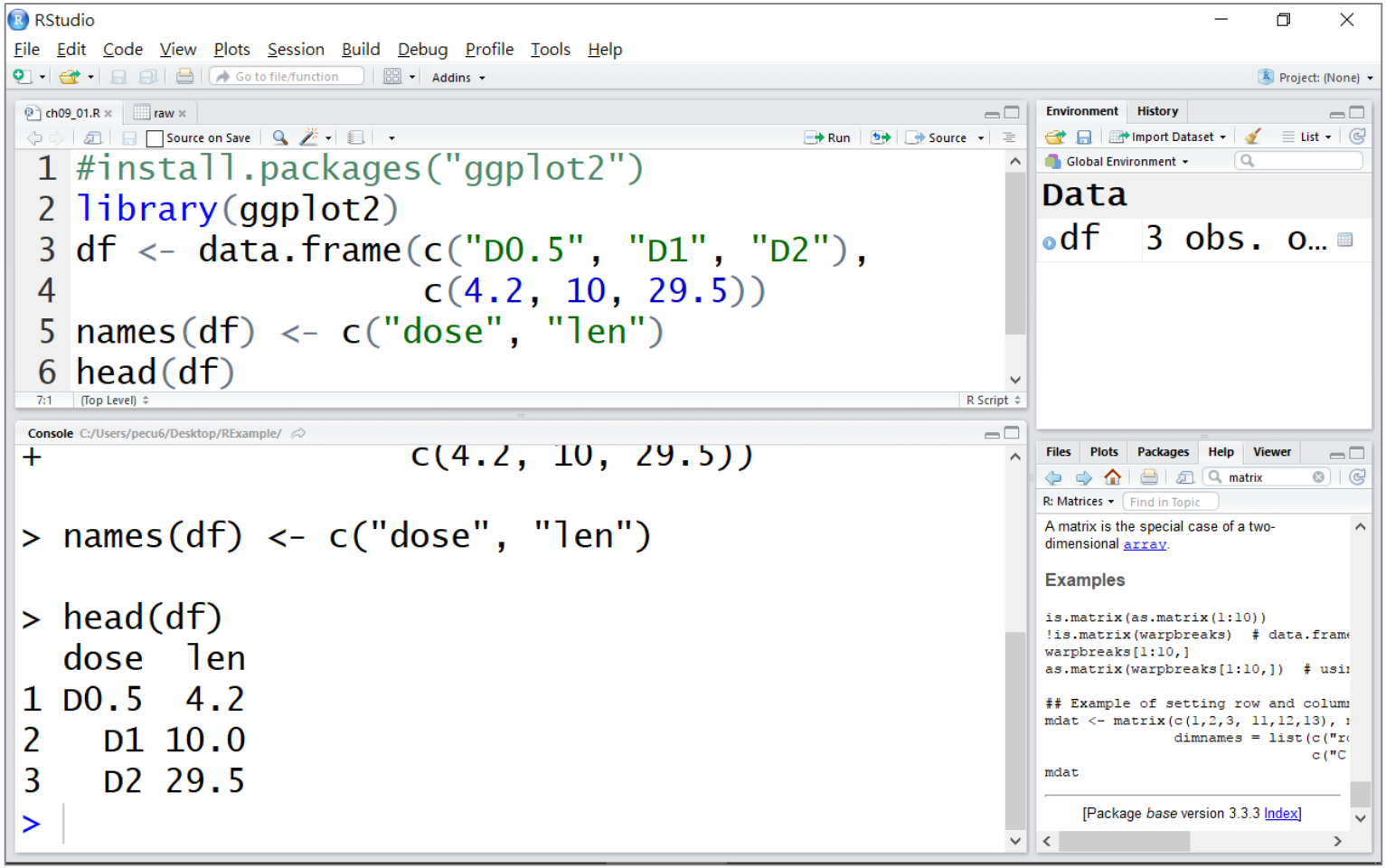



```
ggplot(diamonds, aes(clarity, fill=cut)) +
geom_bar(position="fill") +
theme_dark()
```

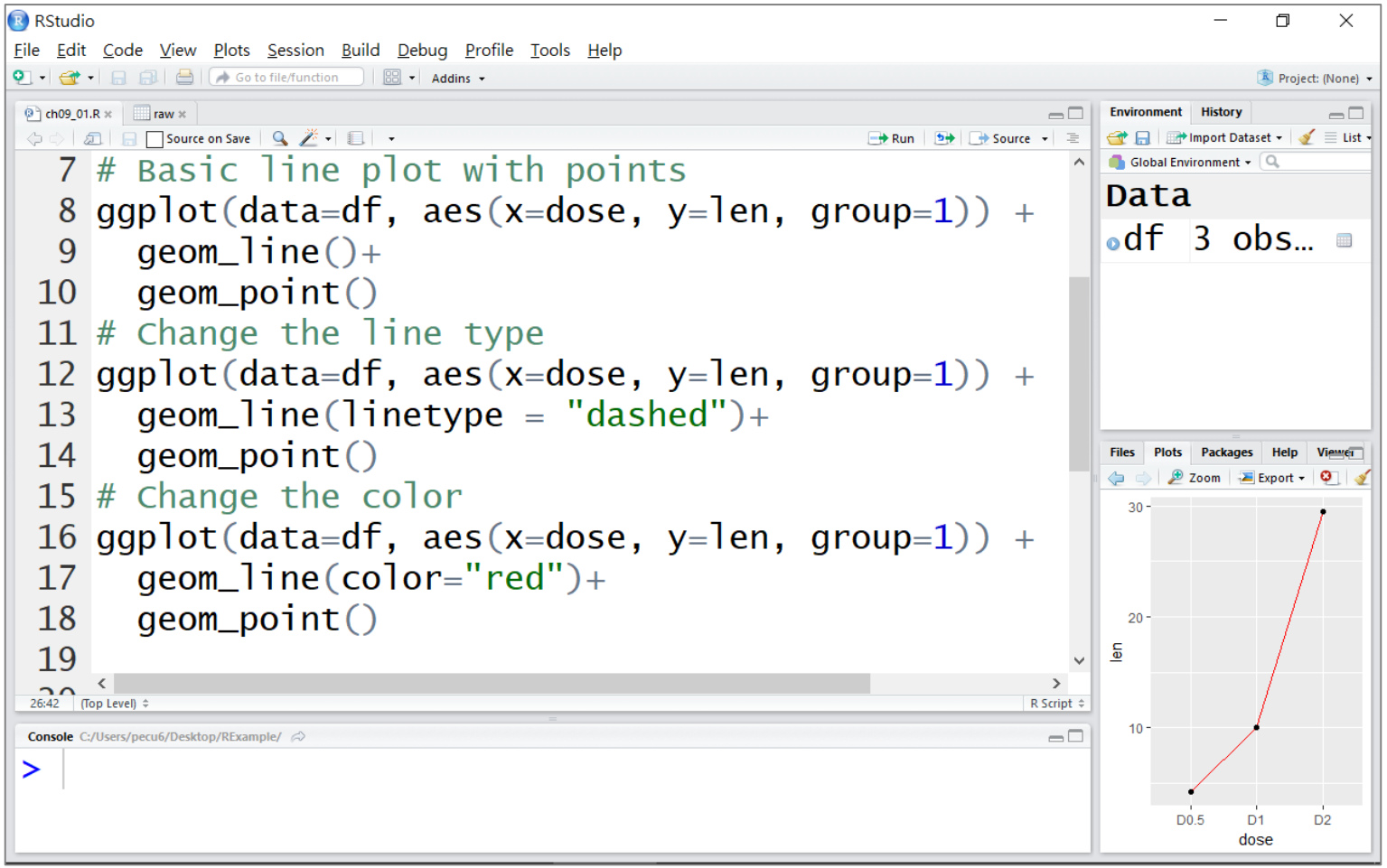
應用 ggplot2

- ggplot2 中的 gg 分別為 grammar graphics
- 字面上的意思就是，用程式文法來控制圖形
- 依序介紹
  - 折線圖
  - 長條圖
  - 散佈圖
  - 堆疊直方圖
  - 盒形圖

折線圖 – 單線資料

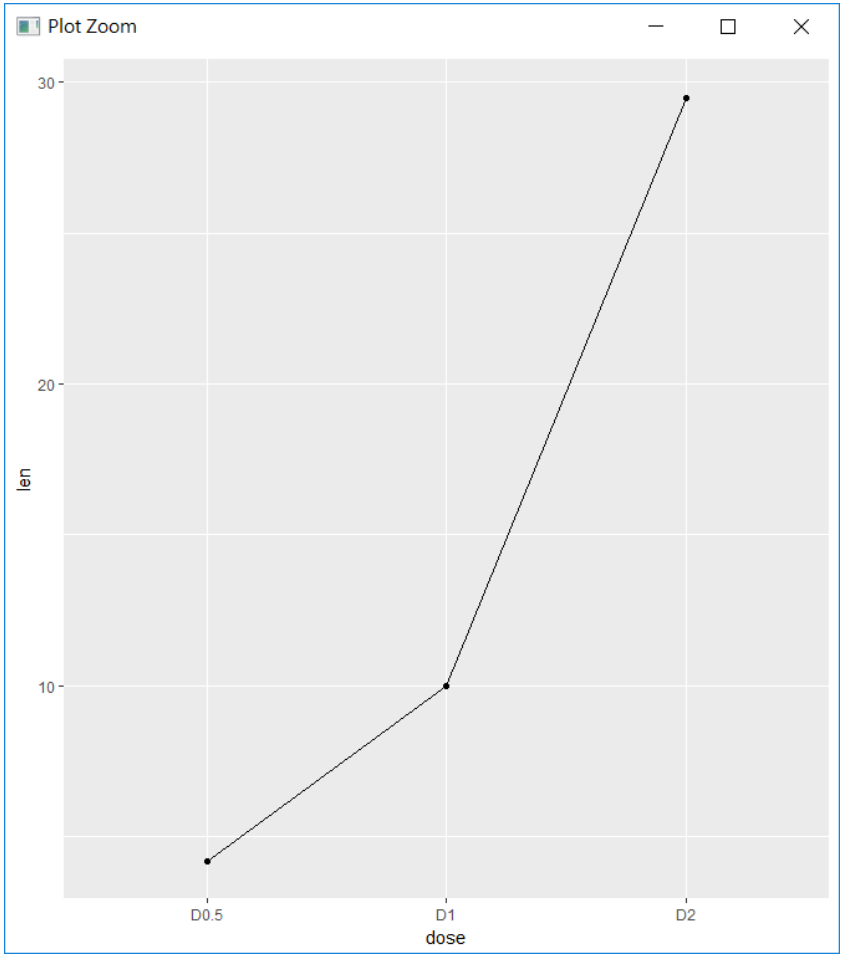

RStudio
File Edit Code View Plots Session Build Debug Profile Tools Help
ch09_01.R
raw
Source on Save
Run
Source
1 #install.packages("ggplot2")
2 library(ggplot2)
3 df <- data.frame(c("D0.5", "D1", "D2"),
4 c(4.2, 10, 29.5))
5 names(df) <- c("dose", "len")
6 head(df)
7:1 (Top Level)
R Script
Console C:/Users/pecu6/Desktop/RExample/
+ c(4.2, 10, 29.5))
> names(df) <- c("dose", "len")
> head(df)
dose len
1 D0.5 4.2
2 D1 10.0
3 D2 29.5
>
Environment History
Import Dataset
List
Global Environment
Data
df 3 obs. o...
Files Plots Packages Help Viewer
matrix
R: Matrices
Find in Topic
A matrix is the special case of a two-dimensional array.
Examples
is.matrix(as.matrix(1:10))
!is.matrix(warpbreaks) # data.frame
warpbreaks[1:10,]
as.matrix(warpbreaks[1:10,]) # usi
Example of setting row and colum
mdat <- matrix(c(1,2,3, 11,12,13),
dimnames = list(c("r
c("C
mdat
[Package base version 3.3.3 Index]

折線圖 – 單線


RStudio
File Edit Code View Plots Session Build Debug Profile Tools Help
ch09_01.R
raw
Source on Save
Run
Source
7 # Basic line plot with points
8 ggplot(data=df, aes(x=dose, y=len, group=1)) +
9 geom_line()+
10 geom_point()
11 # Change the line type
12 ggplot(data=df, aes(x=dose, y=len, group=1)) +
13 geom_line(linetype = "dashed")+
14 geom_point()
15 # Change the color
16 ggplot(data=df, aes(x=dose, y=len, group=1)) +
17 geom_line(color="red")+
18 geom_point()
19
26:42 (Top Level)
R Script
Console C:/Users/pecu6/Desktop/RExample/
>
Environment History
Import Dataset
Global Environment
Data
df 3 obs...
Files Plots Packages Help Viewer
Zoom
Export
30
20
10
len
D0.5
D1
D2
dose

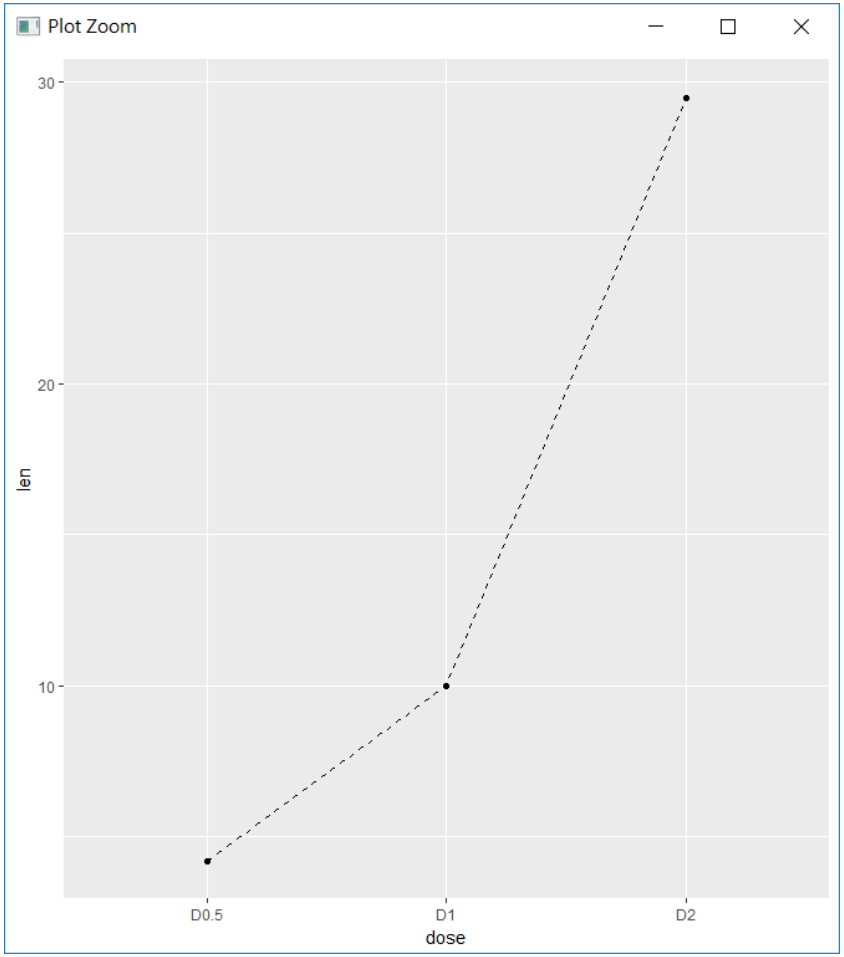
折線圖 - 單線

```
ggplot(data=df,
aes(x=dose, y=len,
group=1)) +
geom_line() +
geom_point()
```



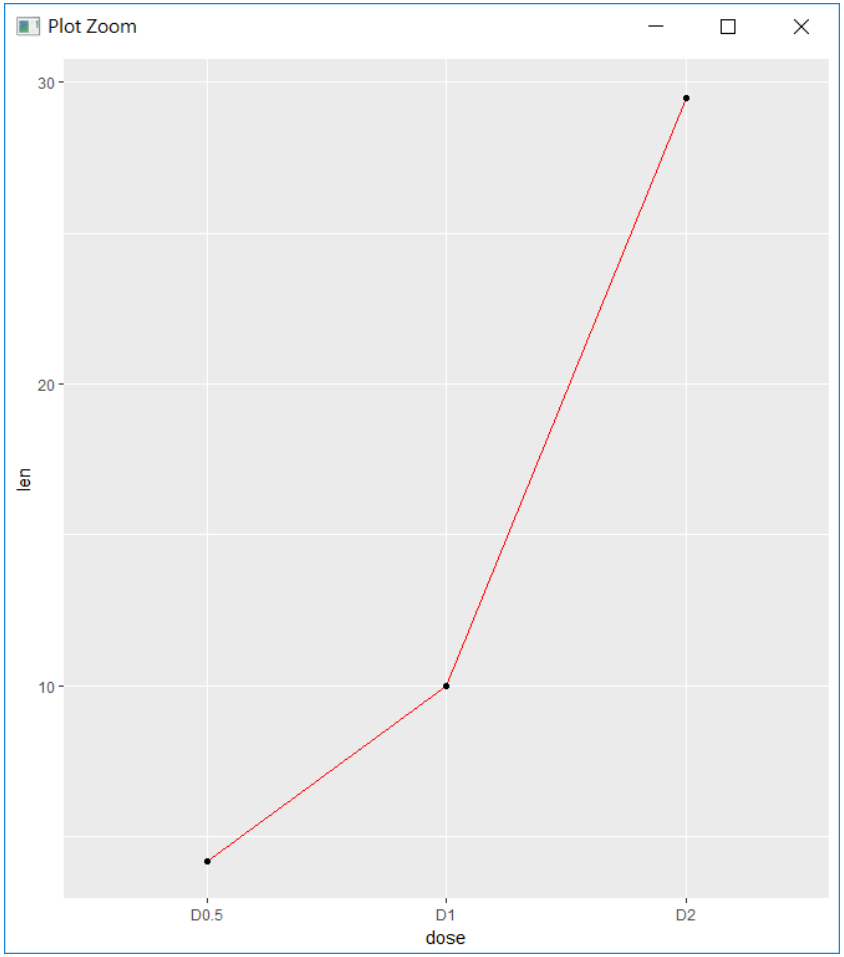
折線圖 – 單線

```
ggplot(data=df,
aes(x=dose, y=len,
group=1)) +
geom_line(linetype =
“dashed”) +
geom_point()
```

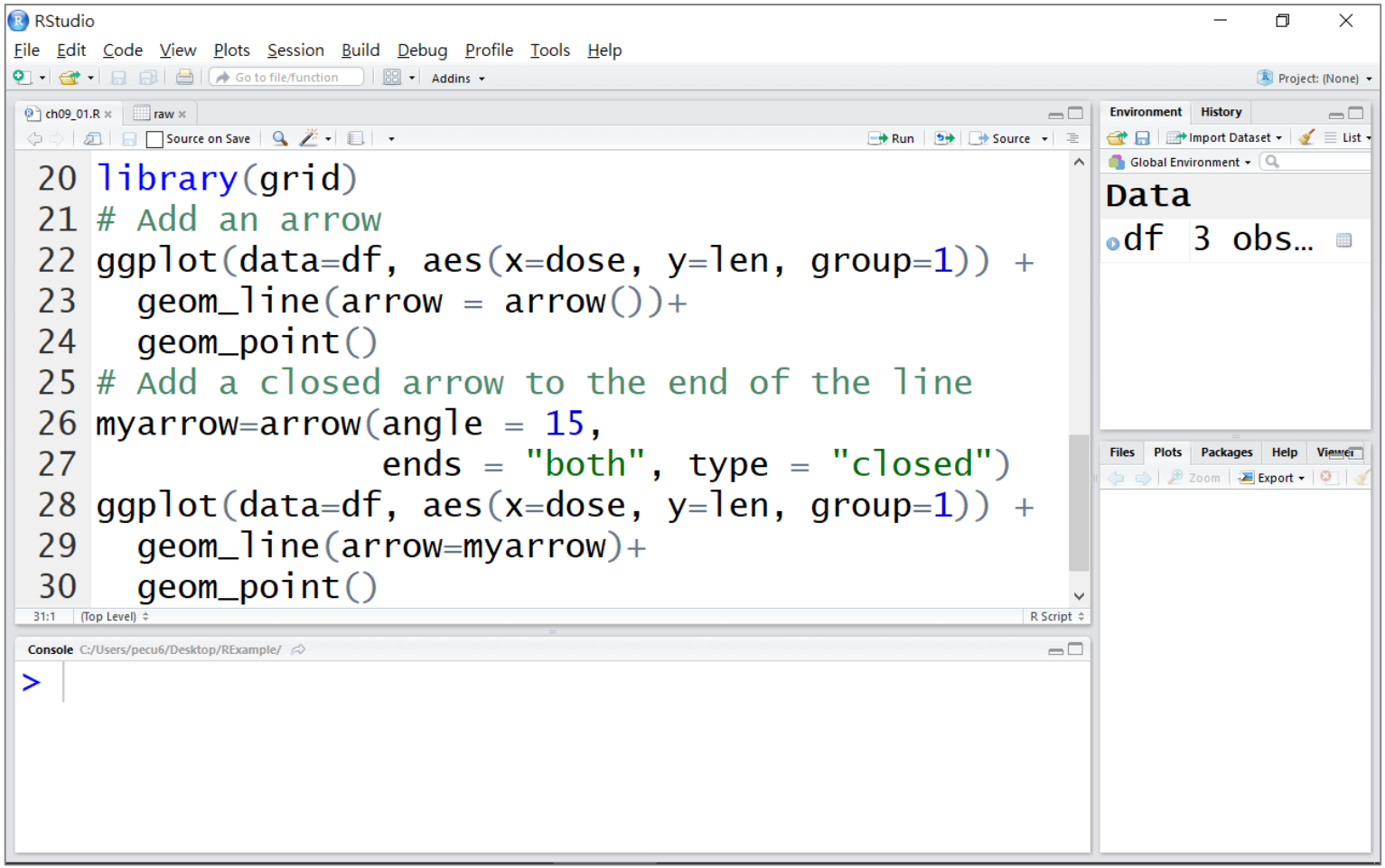


折線圖 – 單線

```
ggplot(data=df,
aes(x=dose, y=len,
group=1)) +
geom_line(color="re
d") +
geom_point()
```

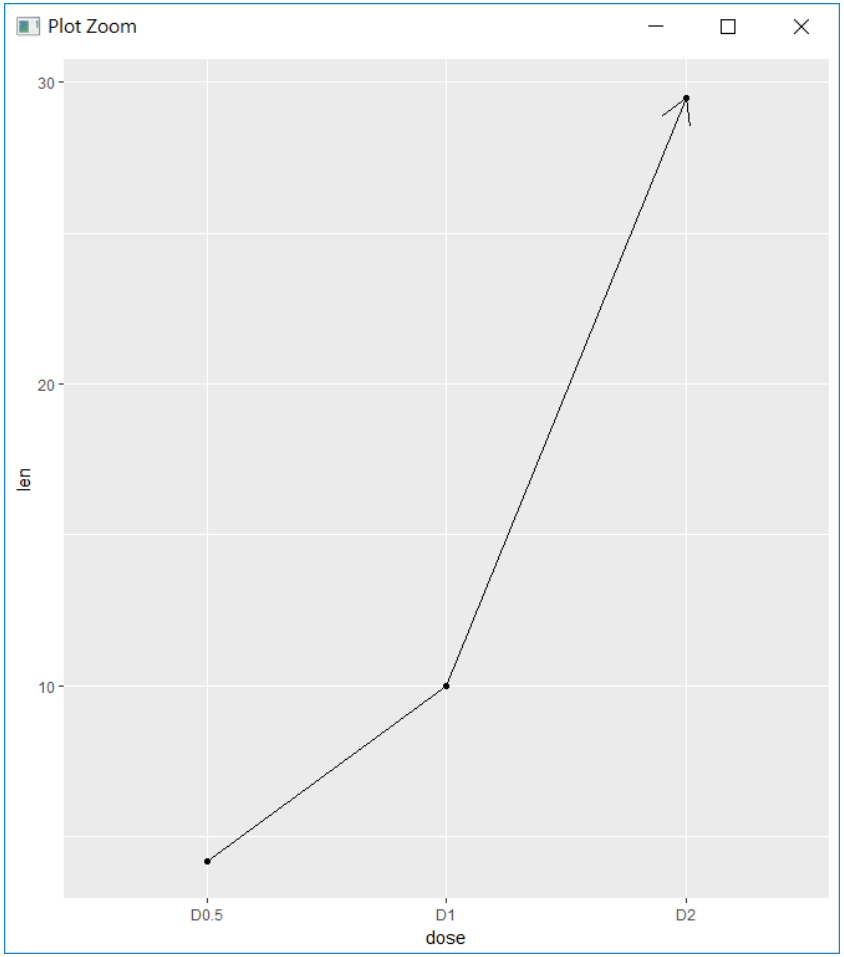


折線圖 – 單線


RStudio
File Edit Code View Plots Session Build Debug Profile Tools Help
Go to file/function
Addins
Project: (None)
ch09_01.R
raw
Source on Save
Run
Source
20 library(grid)
21 # Add an arrow
22 ggplot(data=df, aes(x=dose, y=len, group=1)) +
23 geom_line(arrow = arrow())+
24 geom_point()
25 # Add a closed arrow to the end of the line
26 myarrow=arrow(angle = 15,
27 ends = "both", type = "closed")
28 ggplot(data=df, aes(x=dose, y=len, group=1)) +
29 geom_line(arrow=myarrow)+
30 geom_point()
31:1
(Top Level)
R Script
Console C:/Users/pecu6/Desktop/RExample/
>
Environment
History
Import Dataset
List
Global Environment
Data
df 3 obs...
Files
Plots
Packages
Help
Viewer
Zoom
Export

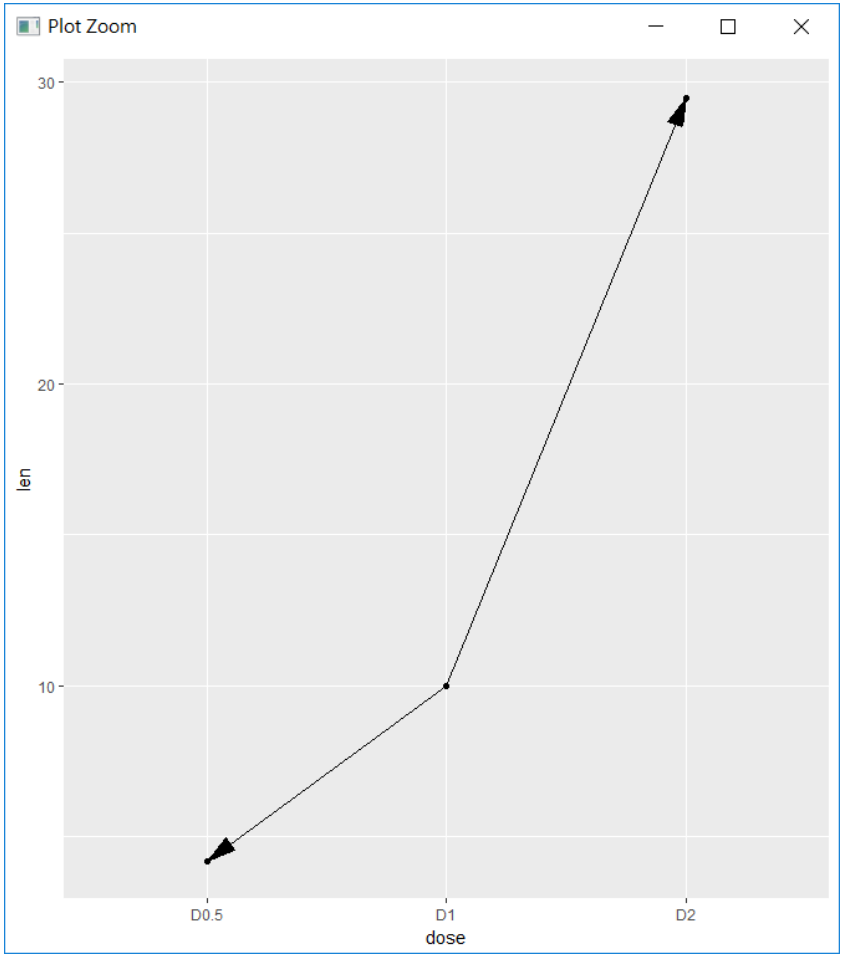
折線圖 - 單線

```
ggplot(data=df,
aes(x=dose, y=len,
group=1)) +
geom_line(arrow =
arrow()) +
geom_point()
```

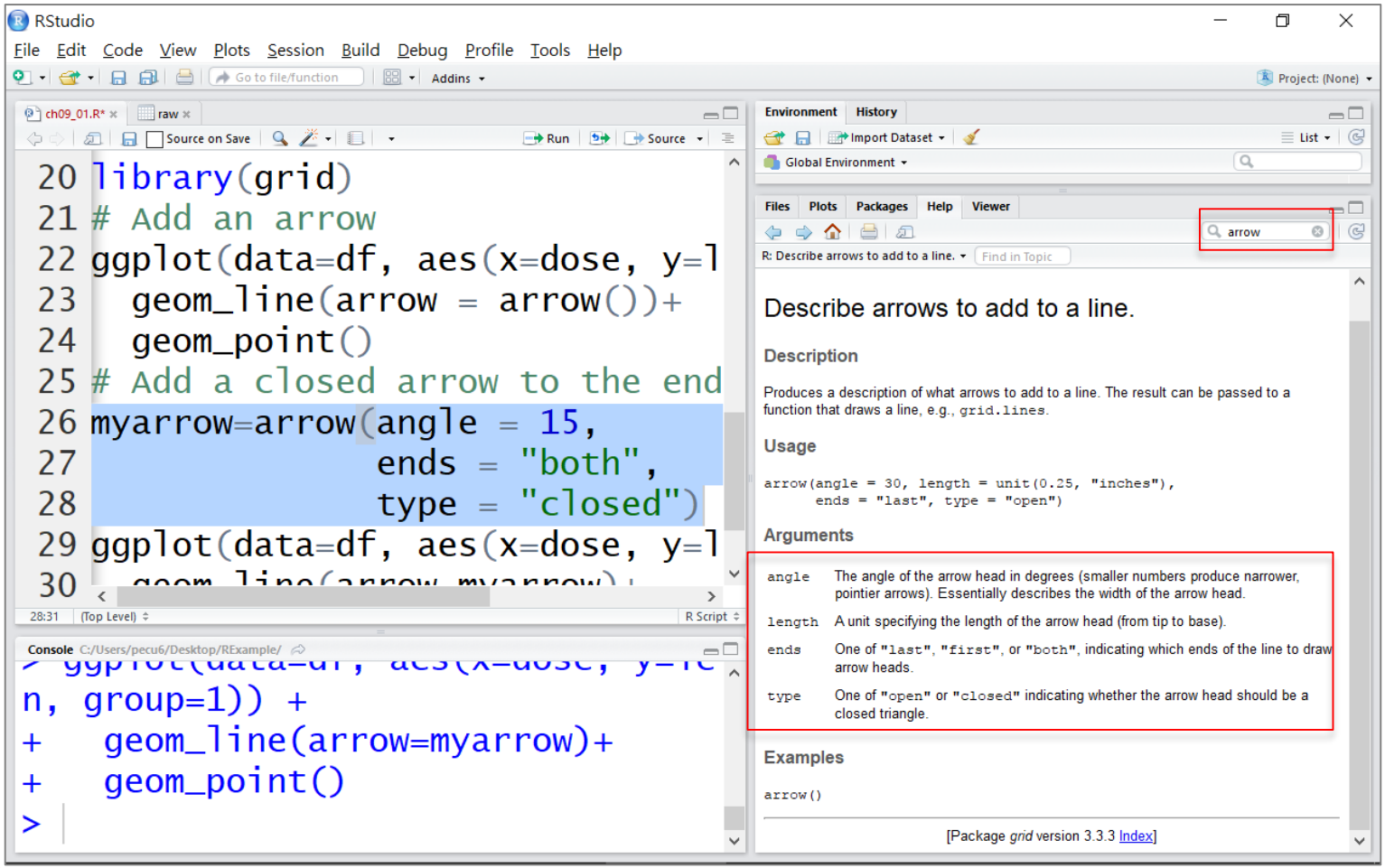


折線圖 - 單線

```
myarrow=arrow(angle = 15, ends = "both", type = "closed")
ggplot(data=df, aes(x=dose, y=len, group=1)) +
geom_line(arrow=myarrow) +
geom_point()
```



R 老師教學時間


RStudio
File Edit Code View Plots Session Build Debug Profile Tools Help
ch09_01.R* raw
Source on Save Run Source
20 library(grid)
21 # Add an arrow
22 ggplot(data=df, aes(x=dose, y=l
23 geom_line(arrow = arrow())+
24 geom_point()
25 # Add a closed arrow to the end
26 myarrow=arrow(angle = 15,
27 ends = "both",
28 type = "closed")
29 ggplot(data=df, aes(x=dose, y=l
30
28:31 (Top Level) R Script
Console C:/Users/pecu6/Desktop/RExample/
n, group=1)) +
+ geom_line(arrow=myarrow)+
+ geom_point()
>
Environment History
Import Dataset List
Global Environment
Files Plots Packages Help Viewer
arrow
R: Describe arrows to add to a line.
Find in Topic
Describe arrows to add to a line.
Description
Produces a description of what arrows to add to a line. The result can be passed to a function that draws a line, e.g., grid.lines.
Usage
arrow(angle = 30, length = unit(0.25, "inches"),
ends = "last", type = "open")
Arguments
angle The angle of the arrow head in degrees (smaller numbers produce narrower, pointier arrows). Essentially describes the width of the arrow head.
length A unit specifying the length of the arrow head (from tip to base).
ends One of "last", "first", or "both", indicating which ends of the line to draw arrow heads.
type One of "open" or "closed" indicating whether the arrow head should be a closed triangle.
Examples
arrow()
[Package grid version 3.3.3 Index]

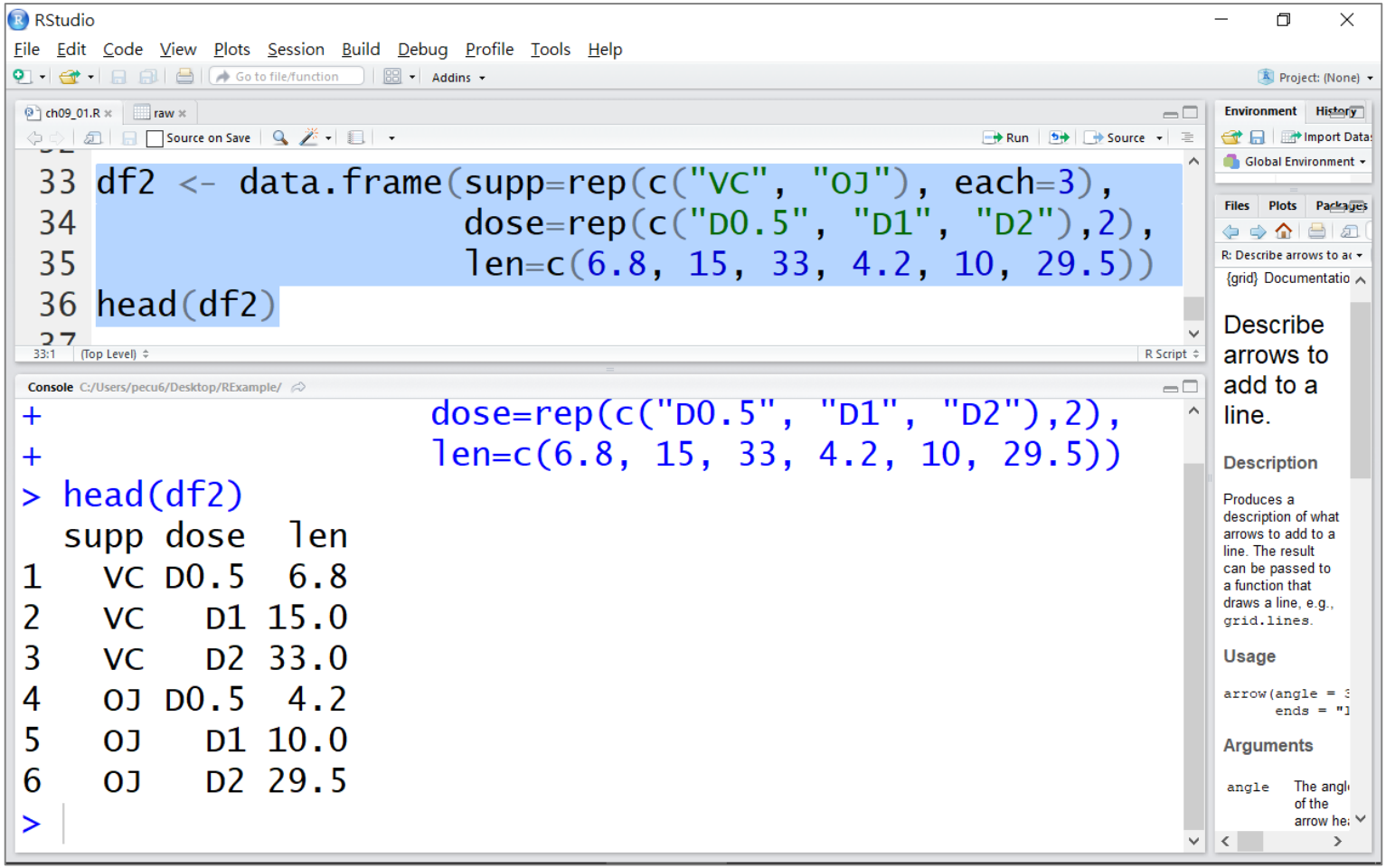
試試其他效果

1. geom_line() : Connecting observations, ordered by x value
2. geom_path() : Observations are connected in original order
3. geom_step() : Connecting observations by stairs

試試其他效果

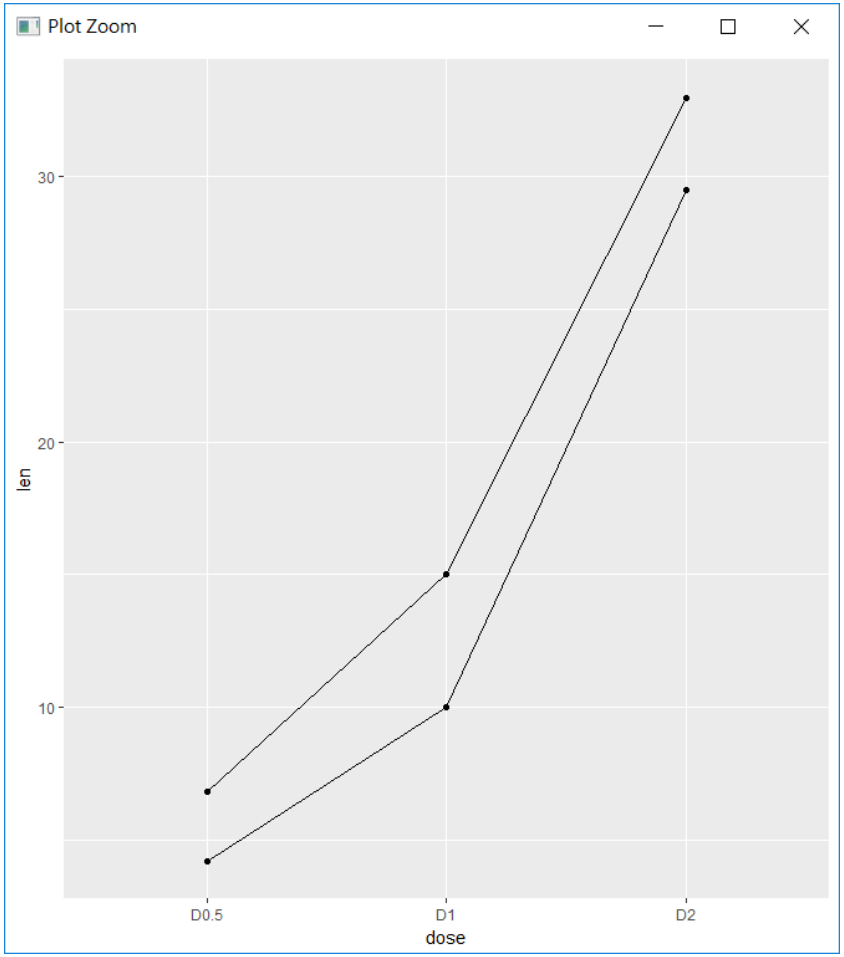
1. ggplot(data=df, aes(x=dose, y=len, group=1)) +
   geom_step() +
   geom_point()
2. ggplot(data=df, aes(x=dose, y=len, group=1)) +
   geom_path() +
   geom_point()

折線圖 – 多線資料


RStudio
File Edit Code View Plots Session Build Debug Profile Tools Help
ch09_01.R
raw
Source on Save
Run
Source
33 df2 <- data.frame(supp=rep(c("VC", "OJ"), each=3),
34 dose=rep(c("D0.5", "D1", "D2"),2),
35 len=c(6.8, 15, 33, 4.2, 10, 29.5))
36 head(df2)
Console C:/Users/pecu6/Desktop/RExample/
+ dose=rep(c("D0.5", "D1", "D2"),2),
+ len=c(6.8, 15, 33, 4.2, 10, 29.5))
> head(df2)
supp dose len
1 VC D0.5 6.8
2 VC D1 15.0
3 VC D2 33.0
4 OJ D0.5 4.2
5 OJ D1 10.0
6 OJ D2 29.5
>
Environment
History
Global Environment
Files
Plots
Packages
Describe arrows to add to a line.
Description
Produces a description of what arrows to add to a line. The result can be passed to a function that draws a line, e.g., grid.lines.
Usage
Arguments

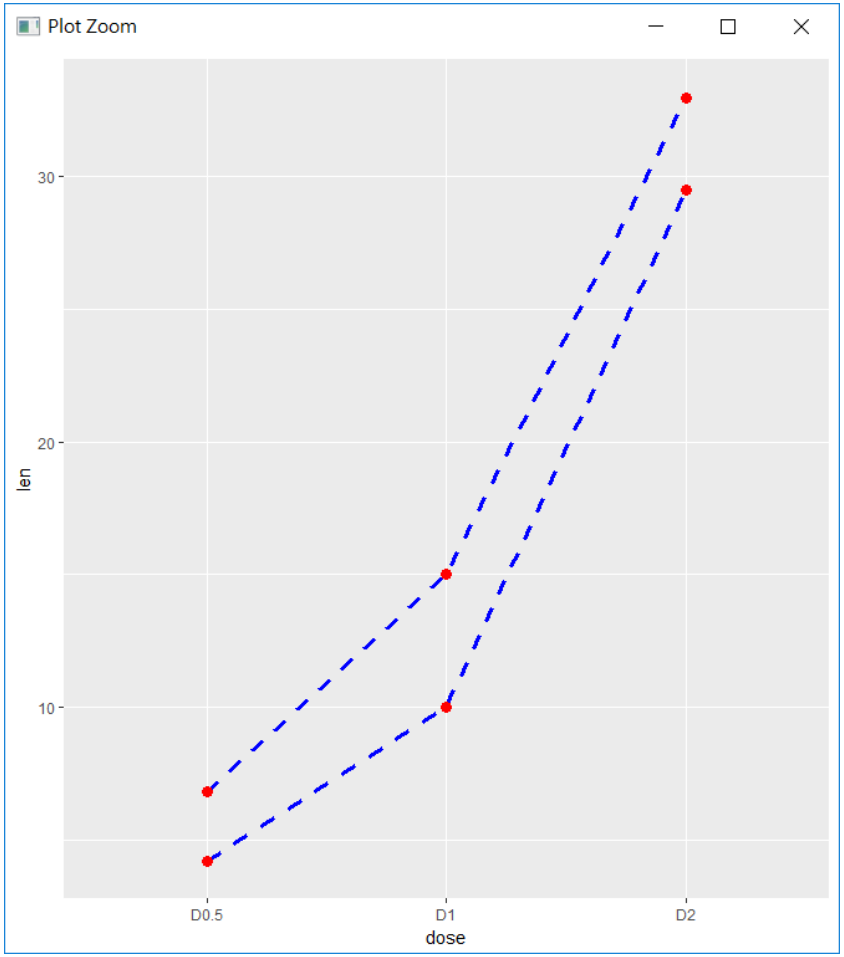
折線圖 - 多線

```
ggplot(data=df2,
aes(x=dose, y=len,
group=supp)) +
geom_line() +
geom_point()
```



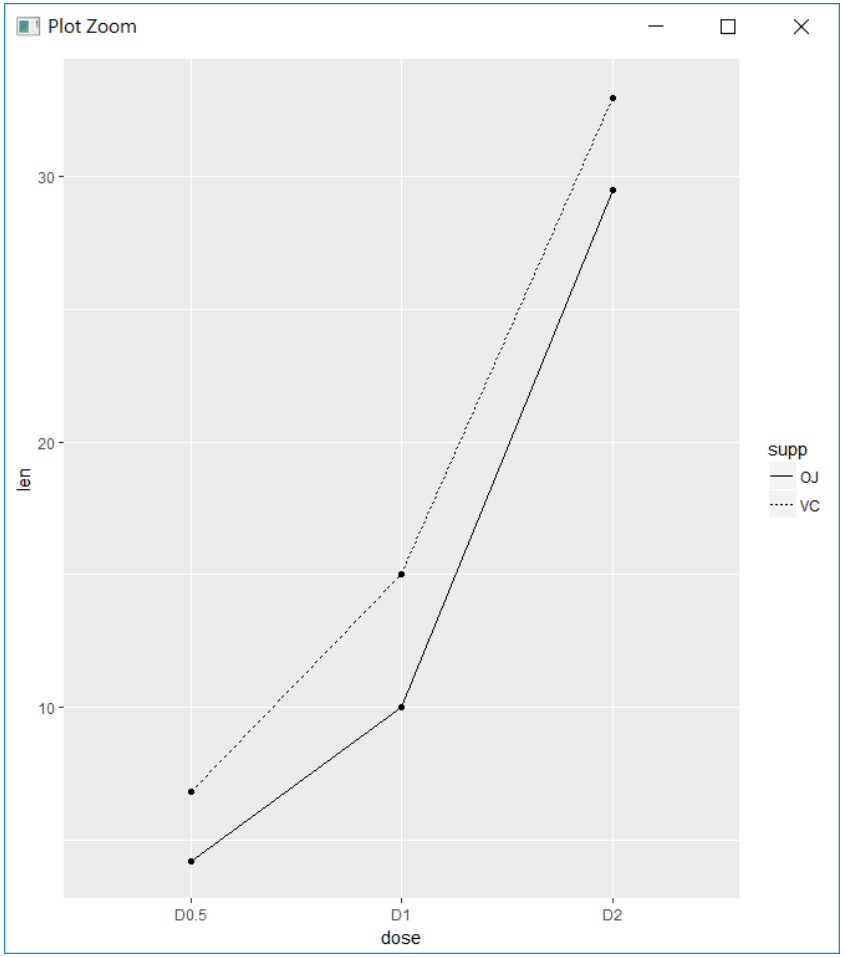
折線圖 - 多線

```
ggplot(data=df2,
aes(x=dose, y=len,
group=supp)) +
geom_line(linetype="
dashed",
color="blue",
size=1.2) +
geom_point(color="r
ed", size=3)
```



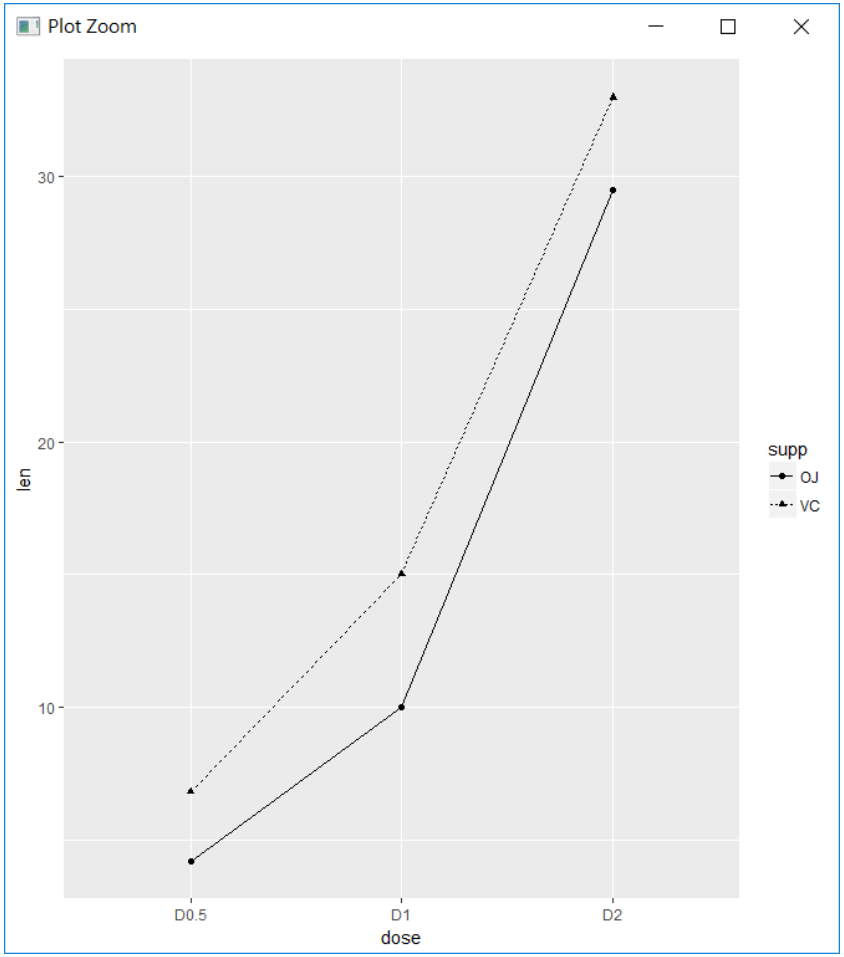
折線圖 - 多線

```
ggplot(df2,
aes(x=dose, y=len,
group=supp)) +
geom_line(aes(linety
pe=supp)) +
geom_point()
```



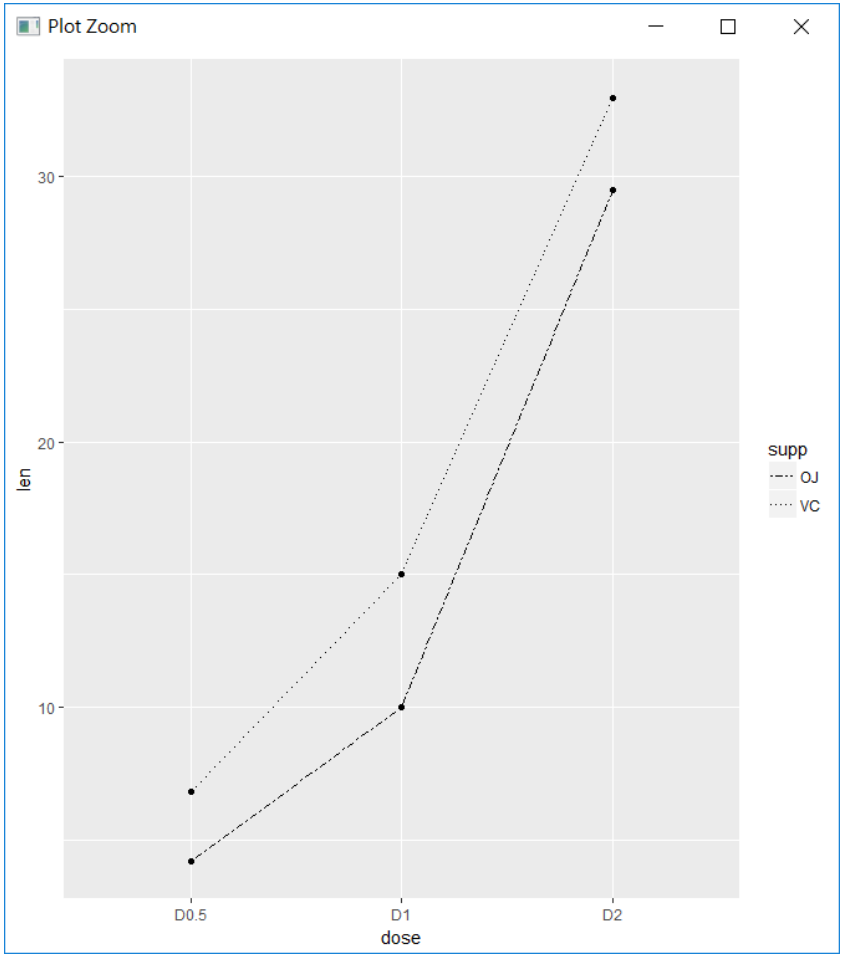
折線圖 - 多線

```
ggplot(df2,
aes(x=dose, y=len,
group=supp)) +
geom_line(aes(linety
pe=supp)) +
geom_point(aes(shap
e=supp))
```



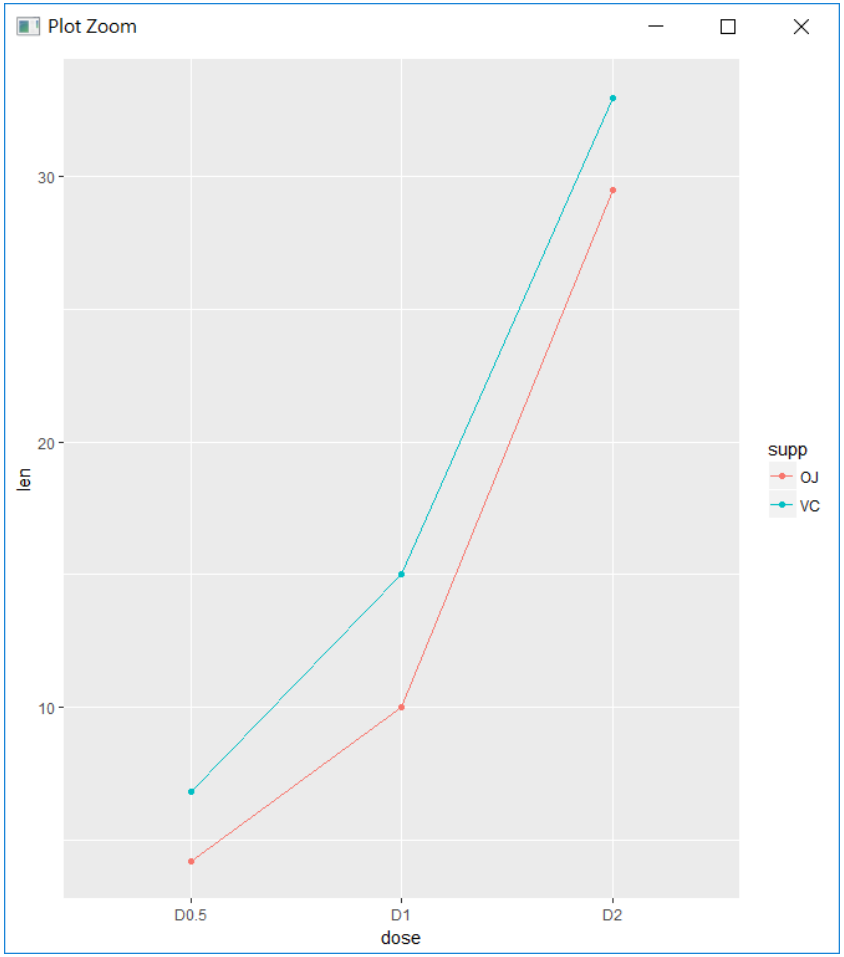
折線圖 – 多線

```
ggplot(df2,
aes(x=dose, y=len,
group=supp)) +
geom_line(aes(linety
pe=supp)) +
geom_point()+
scale_linetype_manu
al(values=c("twodash
", "dotted"))
```



折線圖 - 多線

```
ggplot(df2,
aes(x=dose, y=len,
group=supp)) +
geom_line(aes(color=
supp)) +
geom_point(aes(color
=supp))
```

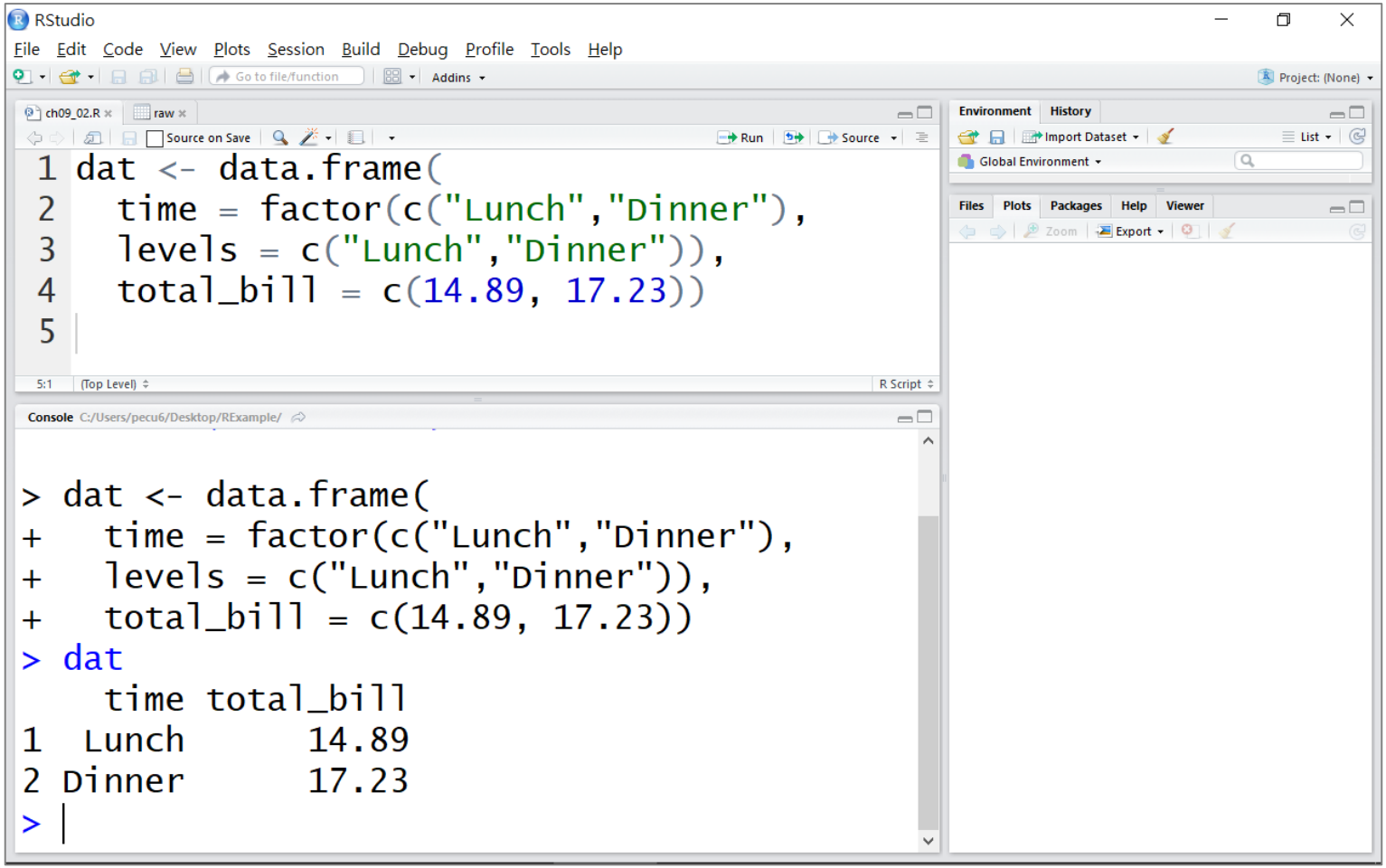


http://www.sthda.com/english/wiki/ggplot2-line-plot-quick-start-guide-r-software-and-data-visualization

長條圖使用時機

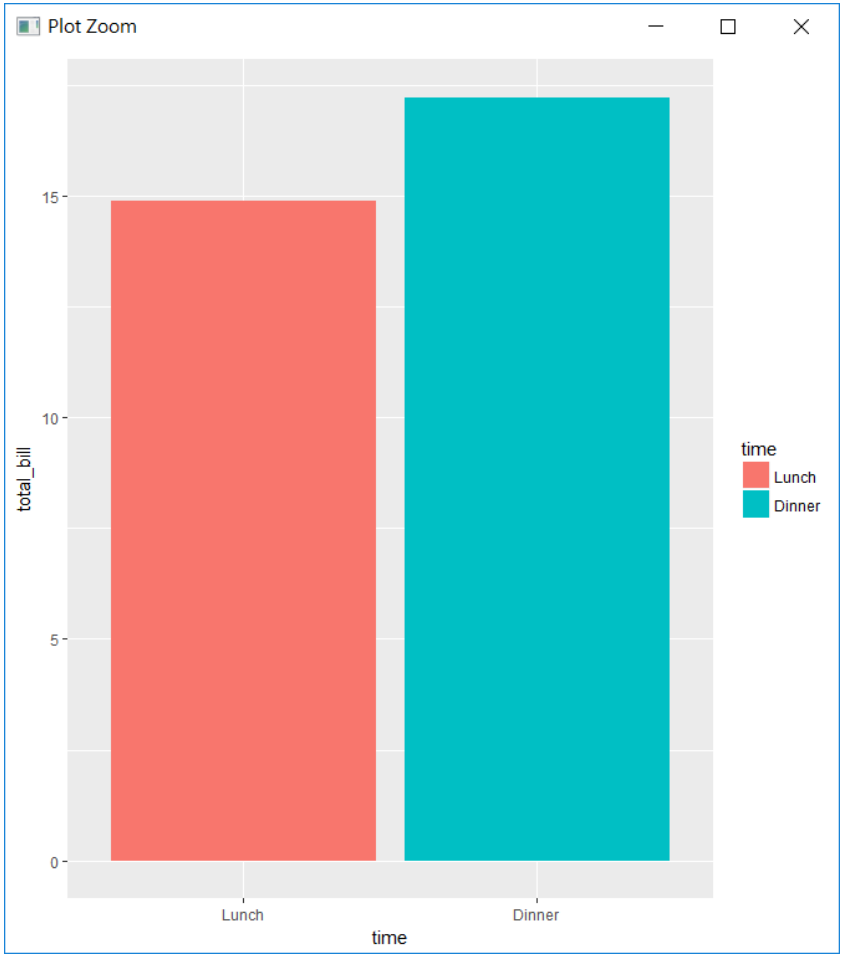
x axis is	Height of bar represents	Common name
Continuous	Count	Histogram
Discrete	Count	Bar graph
Continuous	Value	Bar graph
Discrete	Value	Bar graph

長條圖資料 (已統計或不需統計)



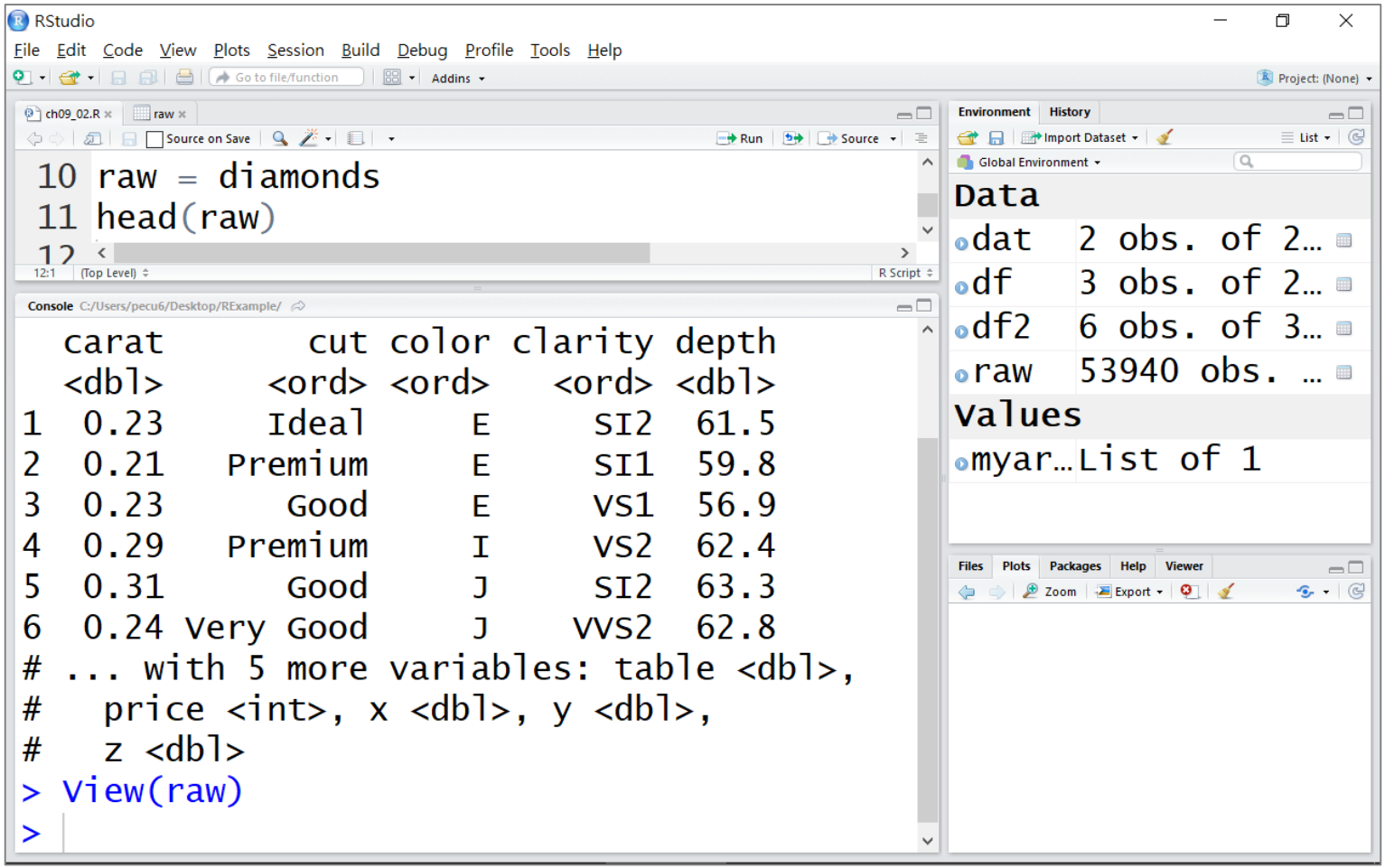
長條圖

```
ggplot(data=dat,
aes(x=time,
y=total_bill,
fill=time)) +
geom_bar(stat="iden
tity")
```



stat 設置為 identity 是直接展示樣本點綁定的縱軸值，而不設 stat 則會統計樣本點落到橫軸上各離散值的個數

長條圖資料 (未統計)


RStudio
File Edit Code View Plots Session Build Debug Profile Tools Help
Go to file/function
Addins
Project: (None)
ch09_02.R
raw
Source on Save
Run
Source
10 raw = diamonds
11 head(raw)
12:1
(Top Level)
R Script
Console C:/Users/pecu6/Desktop/RExample/
carat cut color clarity depth
<dbl> <ord> <ord> <ord> <dbl>
1 0.23 Ideal E SI2 61.5
2 0.21 Premium E SI1 59.8
3 0.23 Good E VS1 56.9
4 0.29 Premium I VS2 62.4
5 0.31 Good J SI2 63.3
6 0.24 Very Good J VVS2 62.8
... with 5 more variables: table <dbl>,
price <int>, x <dbl>, y <dbl>,
z <dbl>
> View(raw)
>
Environment
History
Import Dataset
List
Global Environment
Data
dat 2 obs. of 2…
df 3 obs. of 2…
df2 6 obs. of 3…
raw 53940 obs. …
Values
myar… List of 1
Files
Plots
Packages
Help
Viewer
Zoom
Export

長條圖資料 (未統計)

RStudio Source Editor

raw

Filter

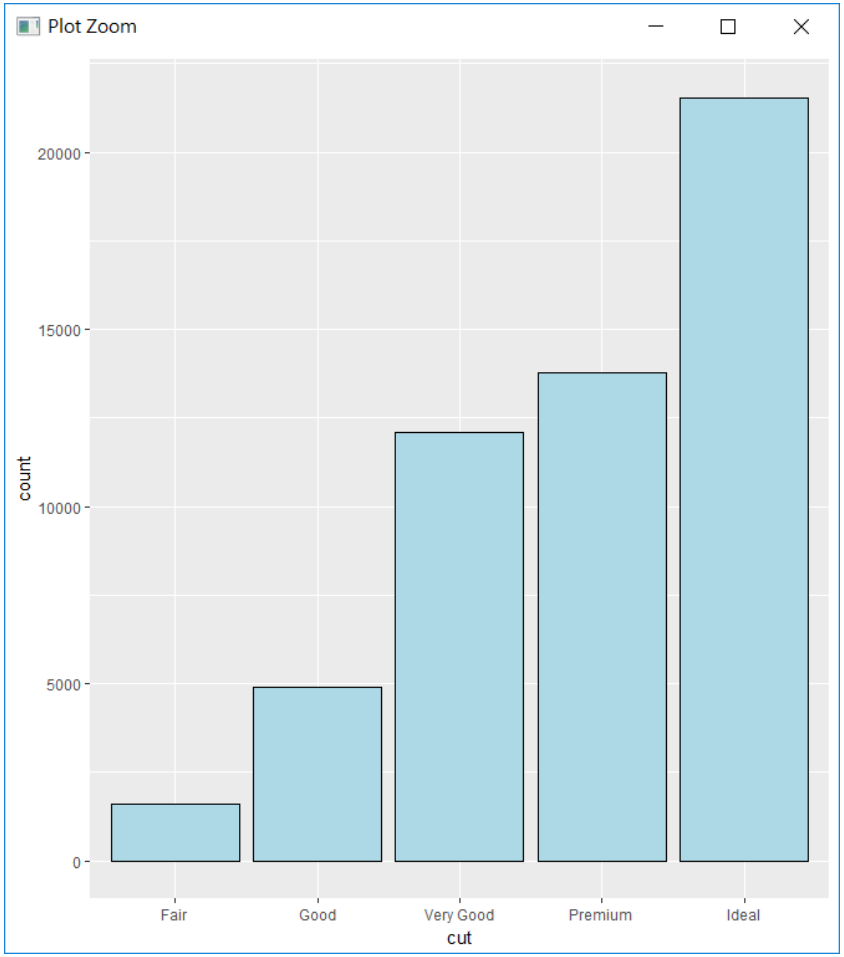
	carat	cut	color	clarity	depth	table	price	x	y	z
1	0.23	Ideal	E	SI2	61.5	55.0	326	3.95	3.98	2.43
2	0.21	Premium	E	SI1	59.8	61.0	326	3.89	3.84	2.31
3	0.23	Good	E	VS1	56.9	65.0	327	4.05	4.07	2.31
4	0.29	Premium	I	VS2	62.4	58.0	334	4.20	4.23	2.63
5	0.31	Good	J	SI2	63.3	58.0	335	4.34	4.35	2.75
6	0.24	Very Good	J	VVS2	62.8	57.0	336	3.94	3.96	2.48
7	0.24	Very Good	I	VVS1	62.3	57.0	336	3.95	3.98	2.47
8	0.26	Very Good	H	SI1	61.9	55.0	337	4.07	4.11	2.53
9	0.22	Fair	E	VS2	65.1	61.0	337	3.87	3.78	2.49
10	0.23	Very Good	H	VS1	59.4	61.0	338	4.00	4.05	2.39
11	0.30	Good	J	SI1	64.0	55.0	339	4.25	4.28	2.73
12	0.23	Ideal	J	VS1	62.8	56.0	340	3.93	3.90	2.46
13	0.22	Premium	F	SI1	60.4	61.0	342	3.88		
14	0.31	Ideal	J	SI2	62.2	54.0	344	4.35		
15	0.20	Premium	E	SI2	60.2	62.0	345	3.79		
16	0.32	Premium	E	I1	60.9	58.0	345	4.38	4.42	2.68
17	0.30	Ideal	I	SI2	62.0	54.0	348	4.31	4.34	2.68
18	0.30	Good	J	SI1	63.4	54.0	351	4.23	4.29	2.70
19	0.30	Good	J	SI1	63.8	56.0	351	4.23	4.26	2.71
20	0.30	Very Good	J	SI1	62.7	59.0	351	4.21	4.27	2.66
21	0.30	Good	I	SI2	63.3	56.0	351	4.26	4.30	2.71
22	0.23	Very Good	E	VS2	63.8	55.0	352	3.85	3.92	2.48
23	0.23	Very Good	H	VS1	61.0	57.0	353	3.94	3.96	2.41
24	0.31	Very Good	J	SI1	59.4	62.0	353	4.39	4.43	2.62
25	0.31	Very Good	J	SI1	58.1	62.0	353	4.44	4.47	2.59
26	0.23	Very Good	G	VVS2	60.4	58.0	354	3.97	4.01	2.41
27	0.24	Premium	I	VS1	62.5	57.0	355	3.97	3.94	2.47
28	0.30	Very Good	J	VS2	62.2	57.0	357	4.28	4.30	2.67
29	0.23	Very Good	D	VS2	60.5	61.0	357	3.96	3.97	2.40

diamonds

Showing 1 to 30 of 53,940 entries

長條圖

```
ggplot(data = diamonds, aes(x = cut)) +
geom_bar(fill = "lightblue", colour = "black")
```



http://www.cookbook-r.com/Graphs/Bar_and_line_graphs_(ggplot2)/

散佈圖資料

RStudio Source Editor

raw

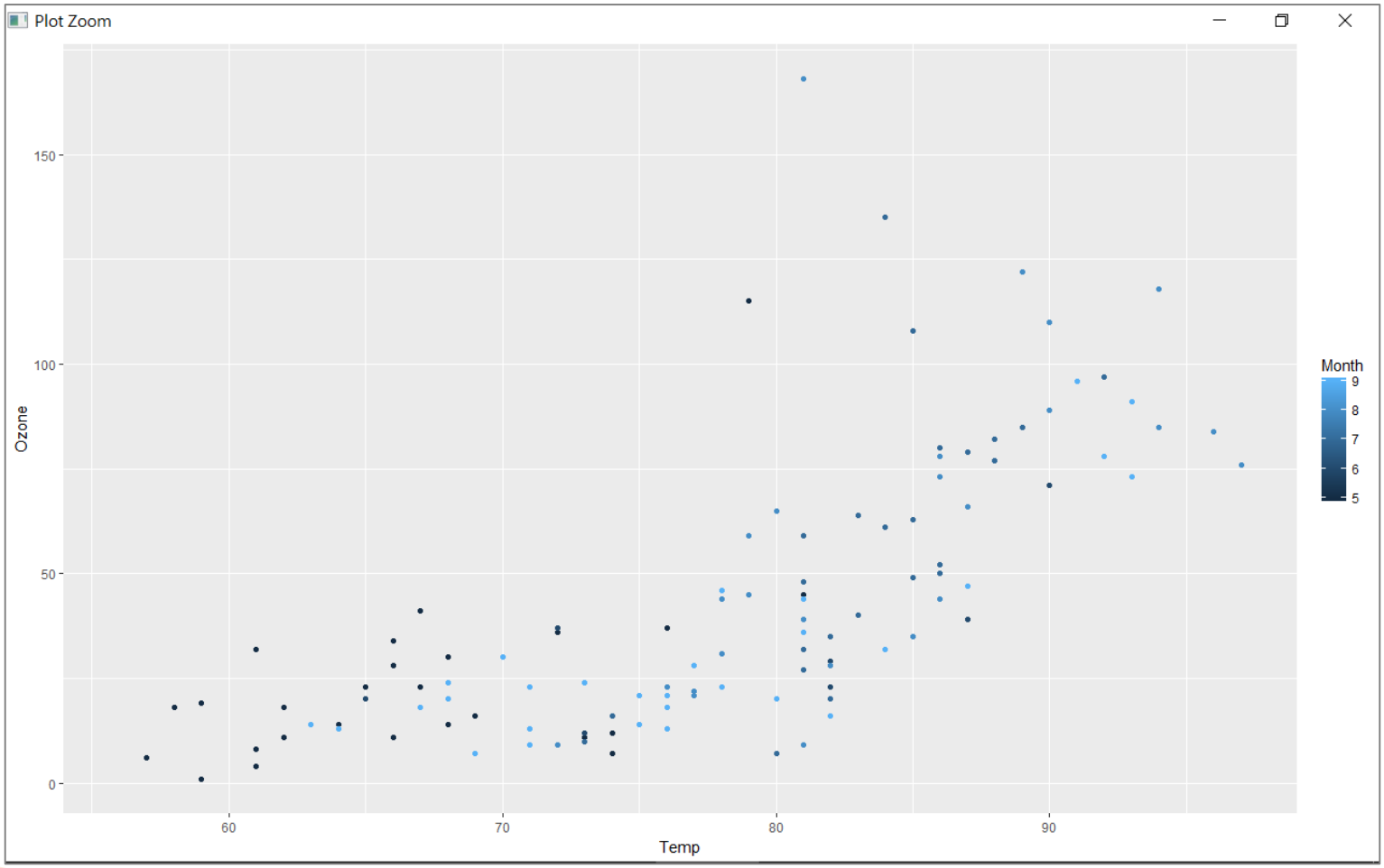
Filter

	Ozone	Solar.R	Wind	Temp	Month	Day
1	41	190	7.4	67	5	1
2	36	118	8.0	72	5	2
3	12	149	12.6	74	5	3
4	18	313	11.5	62	5	4
5	NA	NA	14.3	56	5	5
6	28	NA	14.9	66	5	6
7	23	299	8.6	65	5	7
8	19	99	13.8	59	5	8
9	8	19	20.1	61	5	9
10	NA	194	8.6	69	5	10
11	7	NA	6.9	74	5	11
12	16	256	9.7	69	5	12
13	11	290	9.2	66	5	13
14	14	274	10.9	68	5	14
15	18	65	13.2	58	5	15
16	14	334	11.5	64	5	16
17	34	307	12.0	66	5	17
18	6	78	18.4	57	5	18
19	30	322	11.5	68	5	19
20	11	44	9.7	62	5	20
21	1	8	9.7	59	5	21
22	11	320	16.6	73	5	22
23	4	25	9.7	61	5	23
24	32	92	12.0	61	5	24
25	NA	66	16.6	57	5	25
26	NA	266	14.9	58	5	26
27	NA	NA	8.0	57	5	27
28	23	13	12.0	67	5	28
29	45	252	14.9	81	5	29

Showing 1 to 30 of 153 entries

airquality

散佈圖




```
ggplot(data=airquality) +
geom_point(aes(x=Temp, y=Ozone, color=Month))
```

堆疊直方圖資料 (未統計)

RStudio Source Editor

raw

Filter

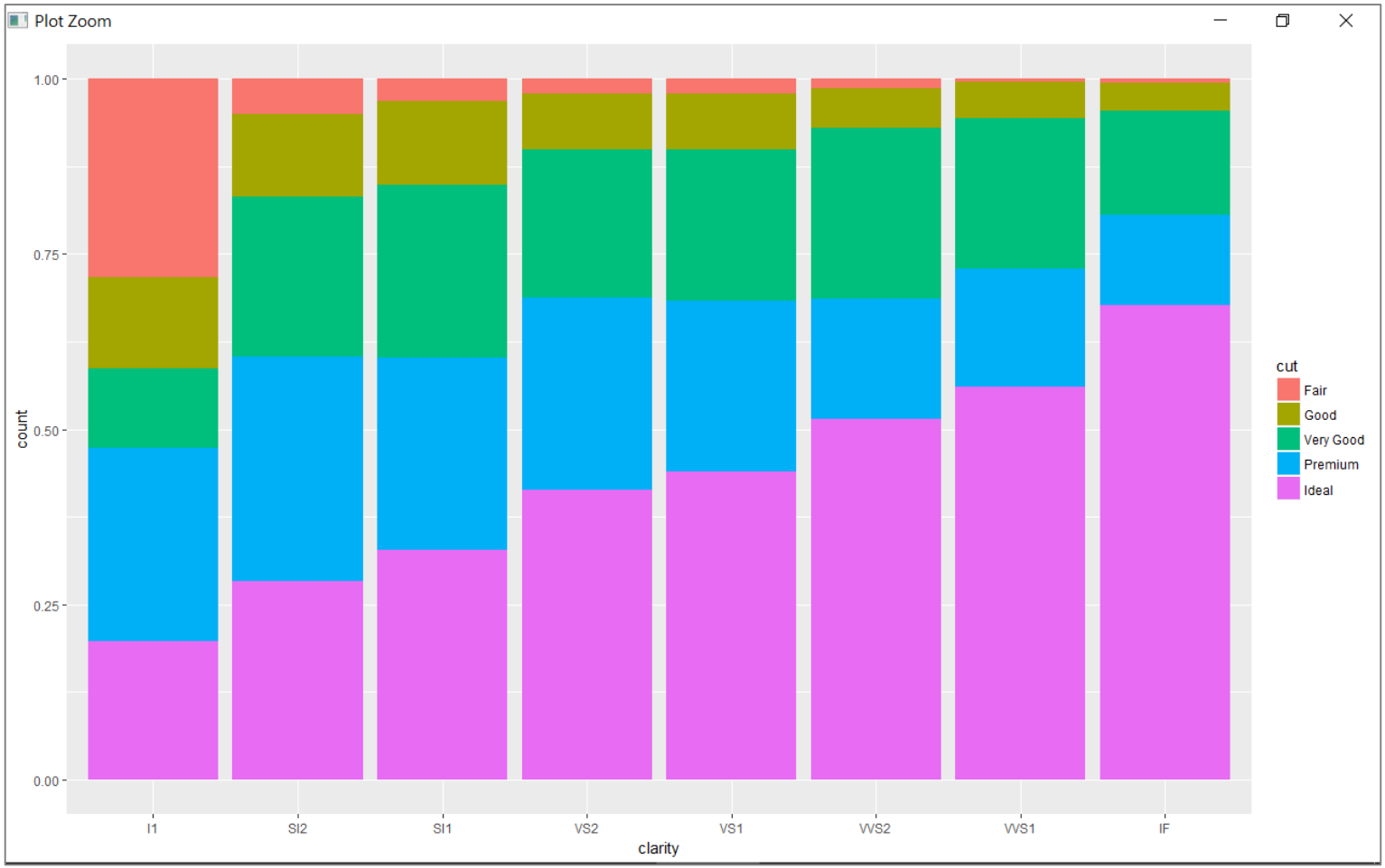
	carat	cut	color	clarity	depth	table	price	x	y	z
1	0.23	Ideal	E	SI2	61.5	55.0	326	3.95	3.98	2.43
2	0.21	Premium	E	SI1	59.8	61.0	326	3.89	3.84	2.31
3	0.23	Good	E	VS1	56.9	65.0	327	4.05	4.07	2.31
4	0.29	Premium	I	VS2	62.4	58.0	334	4.20	4.23	2.63
5	0.31	Good	J	SI2	63.3	58.0	335	4.34	4.35	2.75
6	0.24	Very Good	J	VVS2	62.8	57.0	336	3.94	3.96	2.48
7	0.24	Very Good	I	VVS1	62.3	57.0	336	3.95	3.98	2.47
8	0.26	Very Good	H	SI1	61.9	55.0	337	4.07	4.11	2.53
9	0.22	Fair	E	VS2	65.1	61.0	337	3.87	3.78	2.49
10	0.23	Very Good	H	VS1	59.4	61.0	338	4.00	4.05	2.39
11	0.30	Good	J	SI1	64.0	55.0	339	4.25	4.28	2.73
12	0.23	Ideal	J	VS1	62.8	56.0	340	3.93	3.90	2.46
13	0.22	Premium	F	SI1	60.4	61.0	342	3.88		
14	0.31	Ideal	J	SI2	62.2	54.0	344	4.35		
15	0.20	Premium	E	SI2	60.2	62.0	345	3.79		
16	0.32	Premium	E	I1	60.9	58.0	345	4.38	4.42	2.68
17	0.30	Ideal	I	SI2	62.0	54.0	348	4.31	4.34	2.68
18	0.30	Good	J	SI1	63.4	54.0	351	4.23	4.29	2.70
19	0.30	Good	J	SI1	63.8	56.0	351	4.23	4.26	2.71
20	0.30	Very Good	J	SI1	62.7	59.0	351	4.21	4.27	2.66
21	0.30	Good	I	SI2	63.3	56.0	351	4.26	4.30	2.71
22	0.23	Very Good	E	VS2	63.8	55.0	352	3.85	3.92	2.48
23	0.23	Very Good	H	VS1	61.0	57.0	353	3.94	3.96	2.41
24	0.31	Very Good	J	SI1	59.4	62.0	353	4.39	4.43	2.62
25	0.31	Very Good	J	SI1	58.1	62.0	353	4.44	4.47	2.59
26	0.23	Very Good	G	VVS2	60.4	58.0	354	3.97	4.01	2.41
27	0.24	Premium	I	VS1	62.5	57.0	355	3.97	3.94	2.47
28	0.30	Very Good	J	VS2	62.2	57.0	357	4.28	4.30	2.67
29	0.23	Very Good	D	VS2	60.5	61.0	357	3.96	3.97	2.40

Showing 1 to 30 of 53,940 entries

diamonds

```
ggplot(diamonds, aes(clarity, fill=cut)) +
geom_bar(position="fill")
```

堆疊直方圖




```
ggplot(diamonds, aes(clarity, fill=cut)) +
geom_bar(position="fill")
```

盒形圖資料 (未統計)

RStudio Source Editor

raw ×

Filter

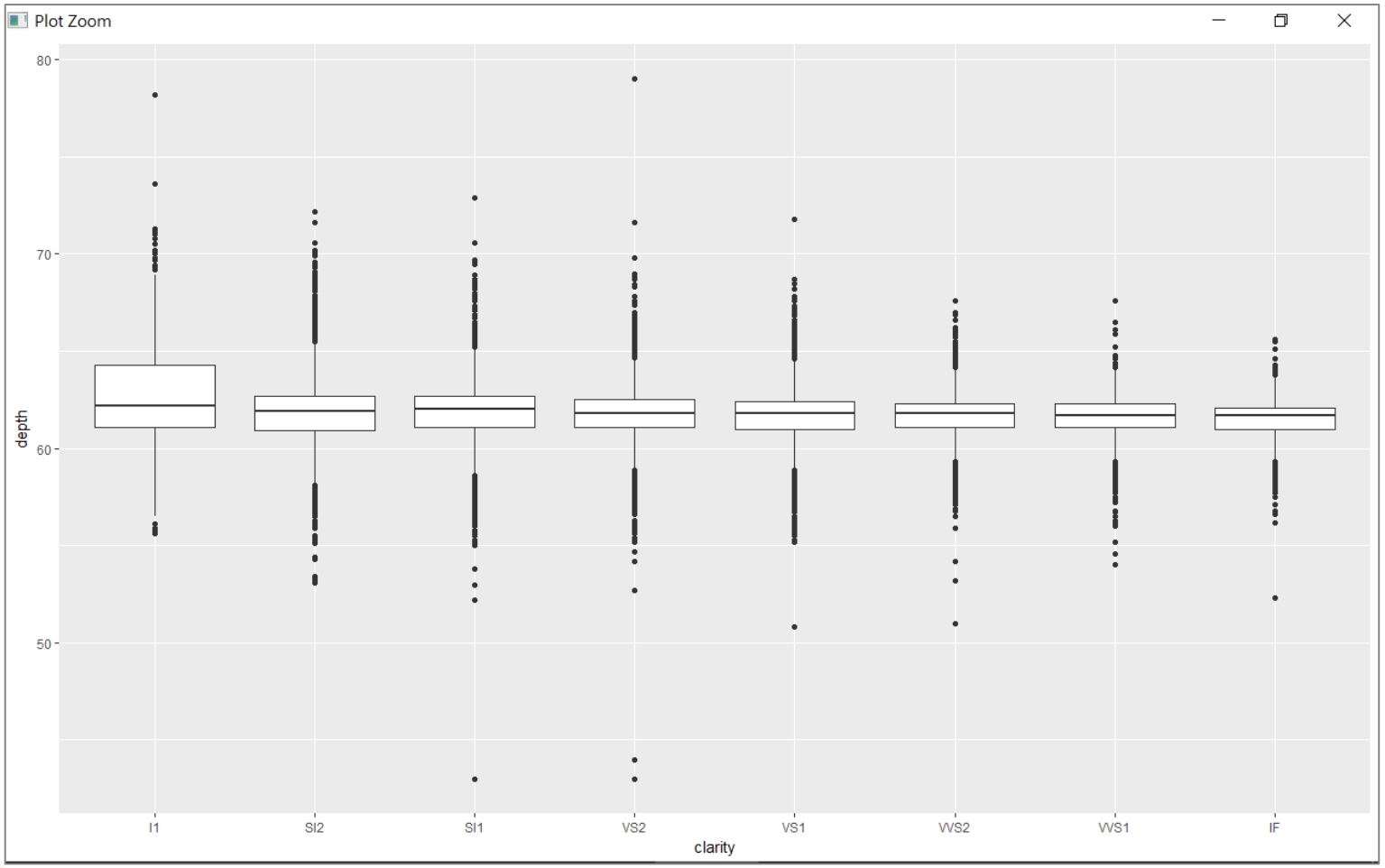
	carat	cut	color	clarity	depth	table	price	x	y	z
1	0.23	Ideal	E	SI2	61.5	55.0	326	3.95	3.98	2.43
2	0.21	Premium	E	SI1	59.8	61.0	326	3.89	3.84	2.31
3	0.23	Good	E	VS1	56.9	65.0	327	4.05	4.07	2.31
4	0.29	Premium	I	VS2	62.4	58.0	334	4.20	4.23	2.63
5	0.31	Good	J	SI2	63.3	58.0	335	4.34	4.35	2.75
6	0.24	Very Good	J	VVS2	62.8	57.0	336	3.94	3.96	2.48
7	0.24	Very Good	I	VVS1	62.3	57.0	336	3.95	3.98	2.47
8	0.26	Very Good	H	SI1	61.9	55.0	337	4.07	4.11	2.53
9	0.22	Fair	E	VS2	65.1	61.0	337	3.87	3.78	2.49
10	0.23	Very Good	H	VS1	59.4	61.0	338	4.00	4.05	2.39
11	0.30	Good	J	SI1	64.0	55.0	339	4.25	4.28	2.73
12	0.23	Ideal	J	VS1	62.8	56.0	340	3.93	3.90	2.46
13	0.22	Premium	F	SI1	60.4	61.0	342	3.88		
14	0.31	Ideal	J	SI2	62.2	54.0	344	4.35		
15	0.20	Premium	E	SI2	60.2	62.0	345	3.79		
16	0.32	Premium	E	I1	60.9	58.0	345	4.38	4.42	2.68
17	0.30	Ideal	I	SI2	62.0	54.0	348	4.31	4.34	2.68
18	0.30	Good	J	SI1	63.4	54.0	351	4.23	4.29	2.70
19	0.30	Good	J	SI1	63.8	56.0	351	4.23	4.26	2.71
20	0.30	Very Good	J	SI1	62.7	59.0	351	4.21	4.27	2.66
21	0.30	Good	I	SI2	63.3	56.0	351	4.26	4.30	2.71
22	0.23	Very Good	E	VS2	63.8	55.0	352	3.85	3.92	2.48
23	0.23	Very Good	H	VS1	61.0	57.0	353	3.94	3.96	2.41
24	0.31	Very Good	J	SI1	59.4	62.0	353	4.39	4.43	2.62
25	0.31	Very Good	J	SI1	58.1	62.0	353	4.44	4.47	2.59
26	0.23	Very Good	G	VVS2	60.4	58.0	354	3.97	4.01	2.41
27	0.24	Premium	I	VS1	62.5	57.0	355	3.97	3.94	2.47
28	0.30	Very Good	J	VS2	62.2	57.0	357	4.28	4.30	2.67
29	0.23	Very Good	D	VS2	60.5	61.0	357	3.96	3.97	2.40

Showing 1 to 30 of 53,940 entries

diamonds

```
ggplot(diamonds, aes(x=clarity, y=depth)) +
geom_boxplot()
```

盒形圖




```
ggplot(diamonds, aes(x=clarity, y=depth)) +
geom_boxplot()
```