2021

A very short introduction to R

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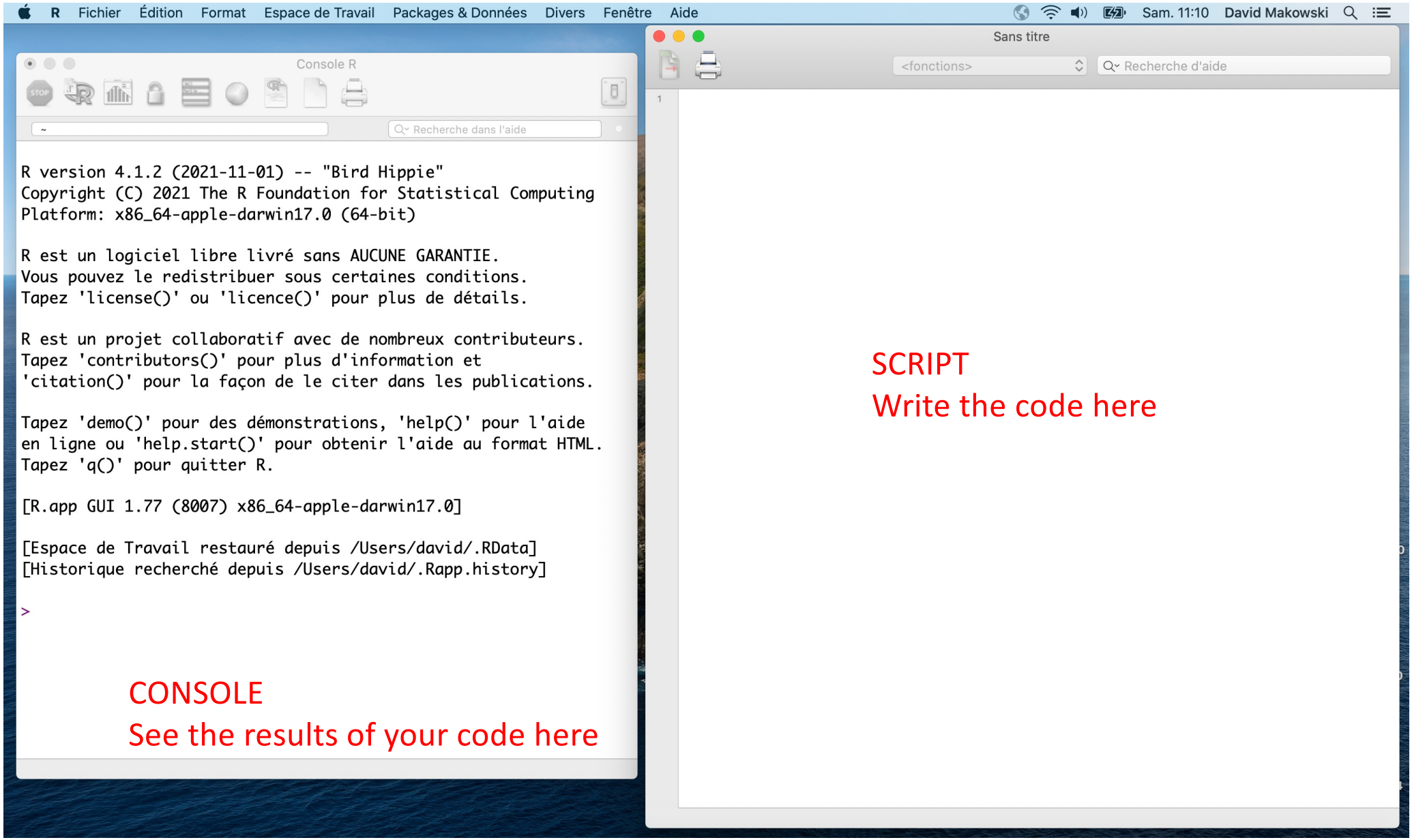
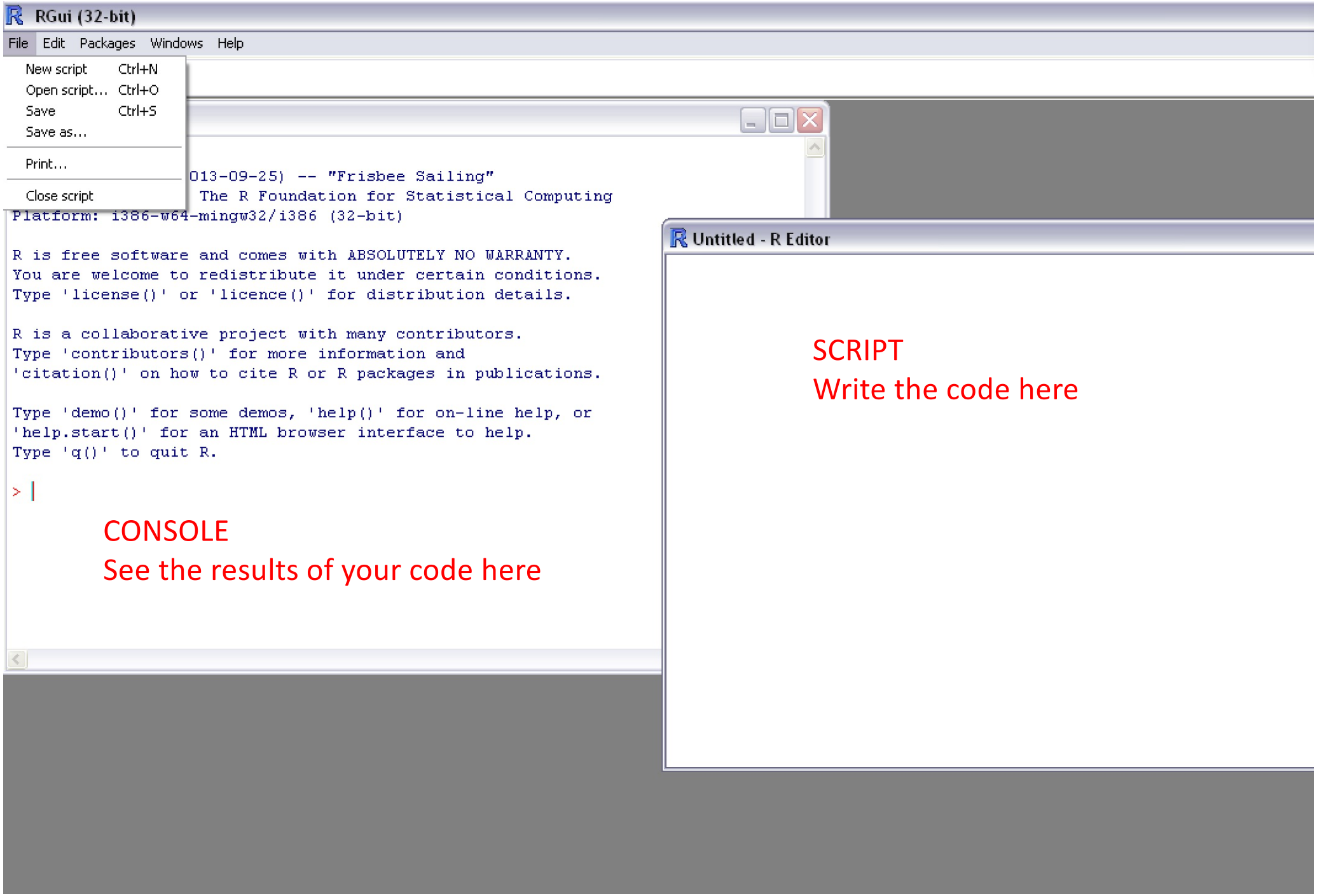
R

- Derived from the language S
- Created in 1993 and developed by *R development core team* (www.r-project.org)
- High level language
- Interpreted (no compilation)
- Free
- Very active community with new packages every year
- Useful for
  - Statistical analysis
  - Machine learning
  - Graphics
  - Modelling
  - Text mining

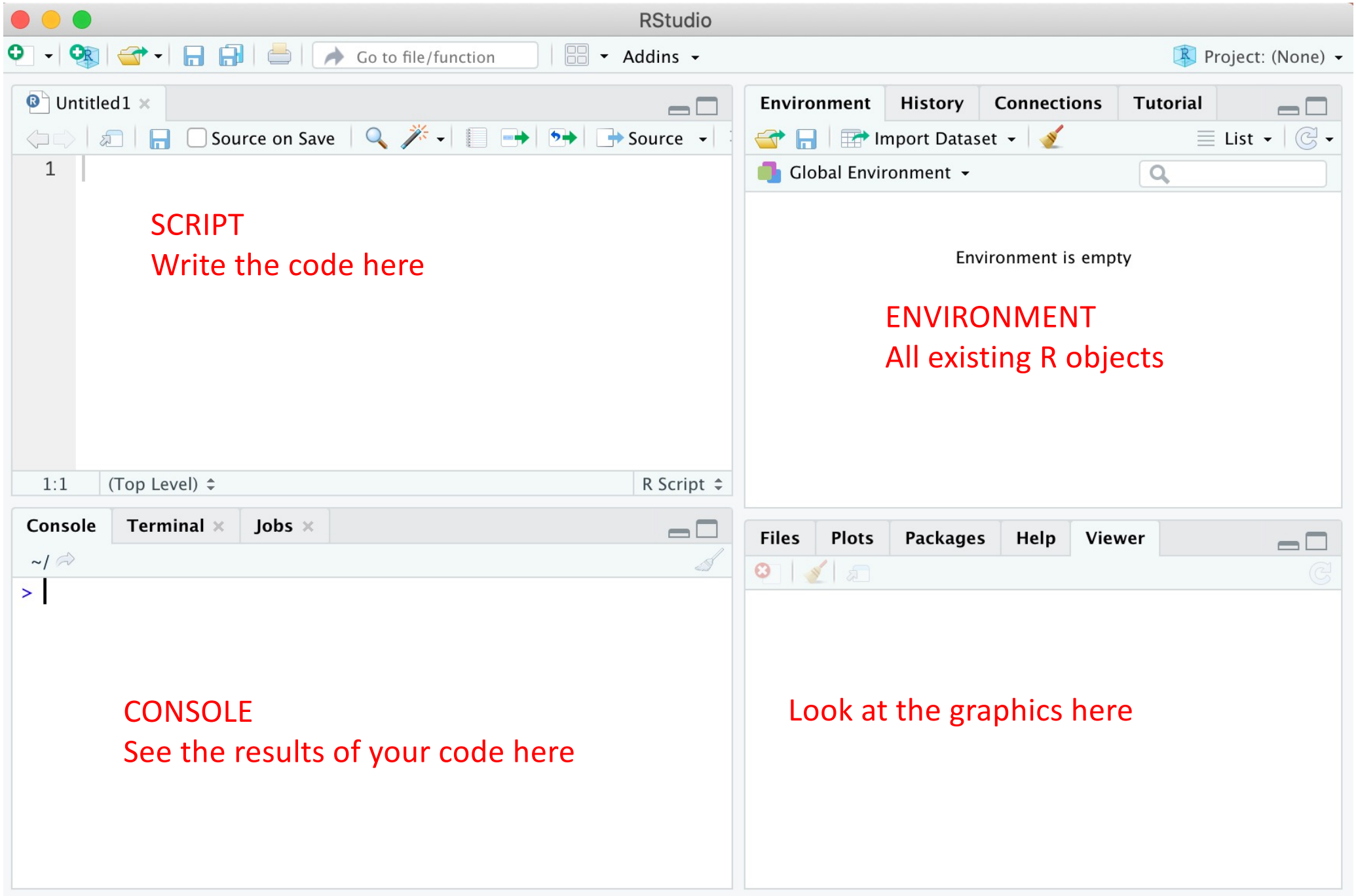
Standard R interface when using a Mac



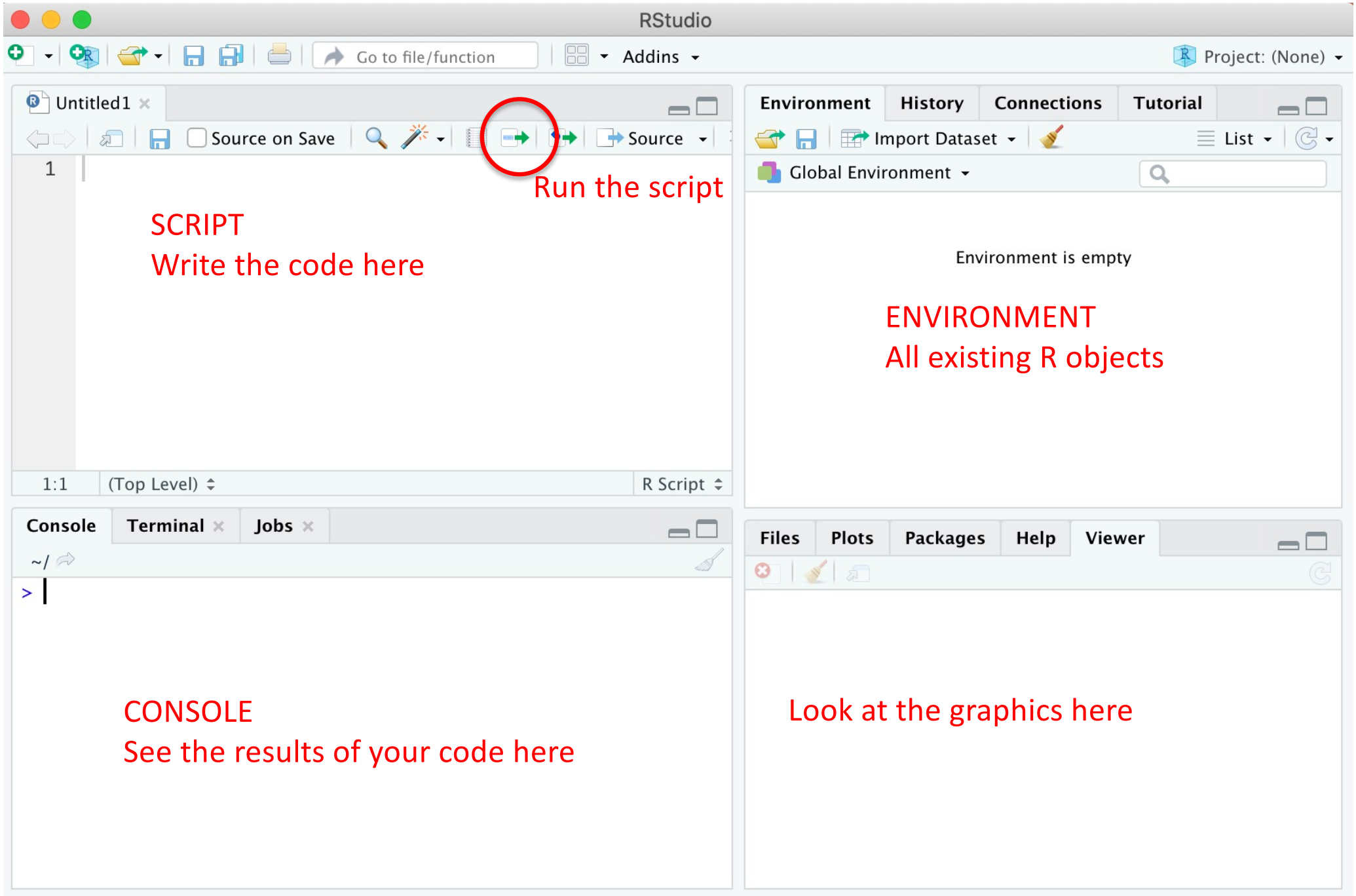
Standard R interface when using Windows



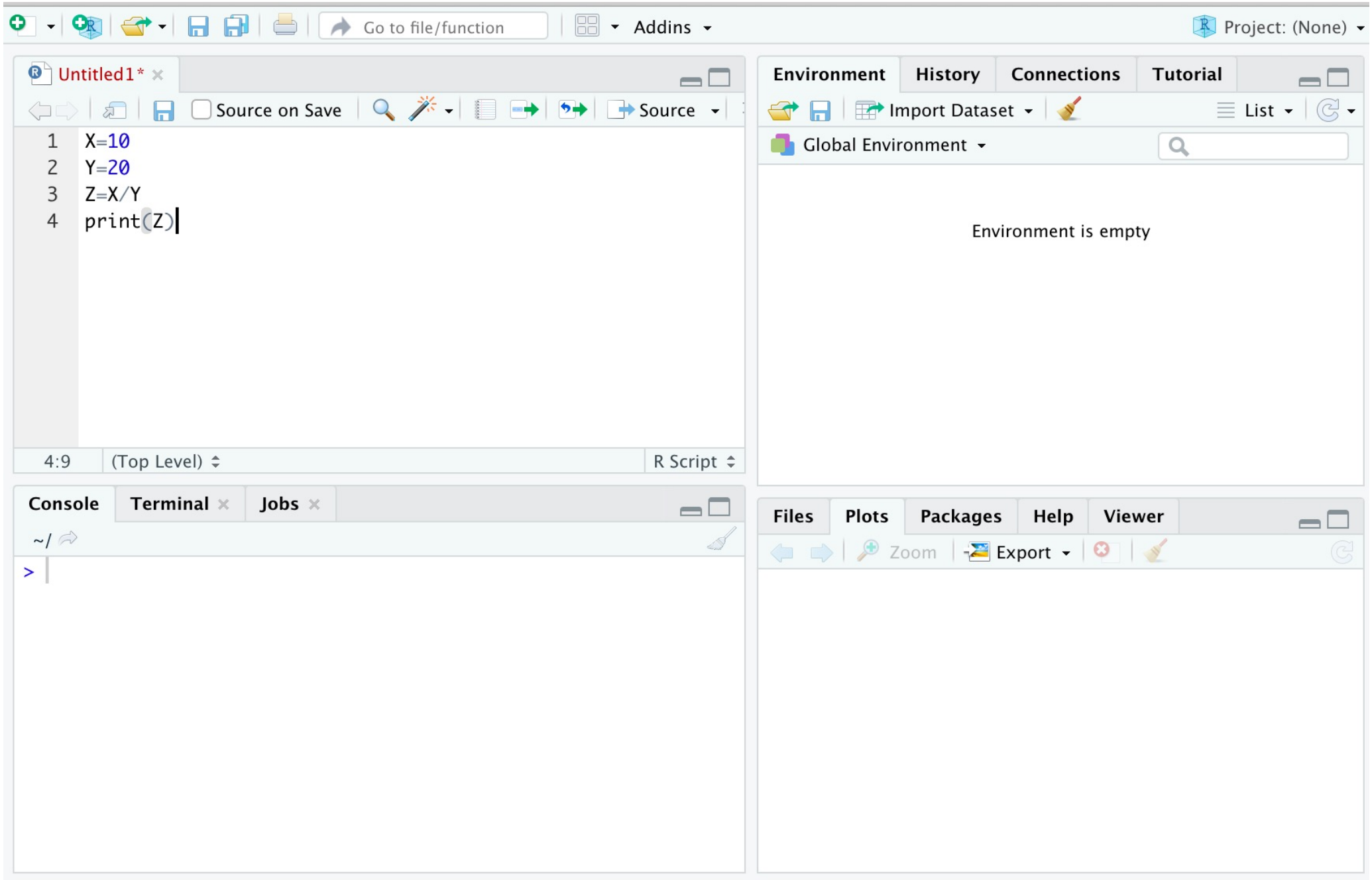
R studio interface



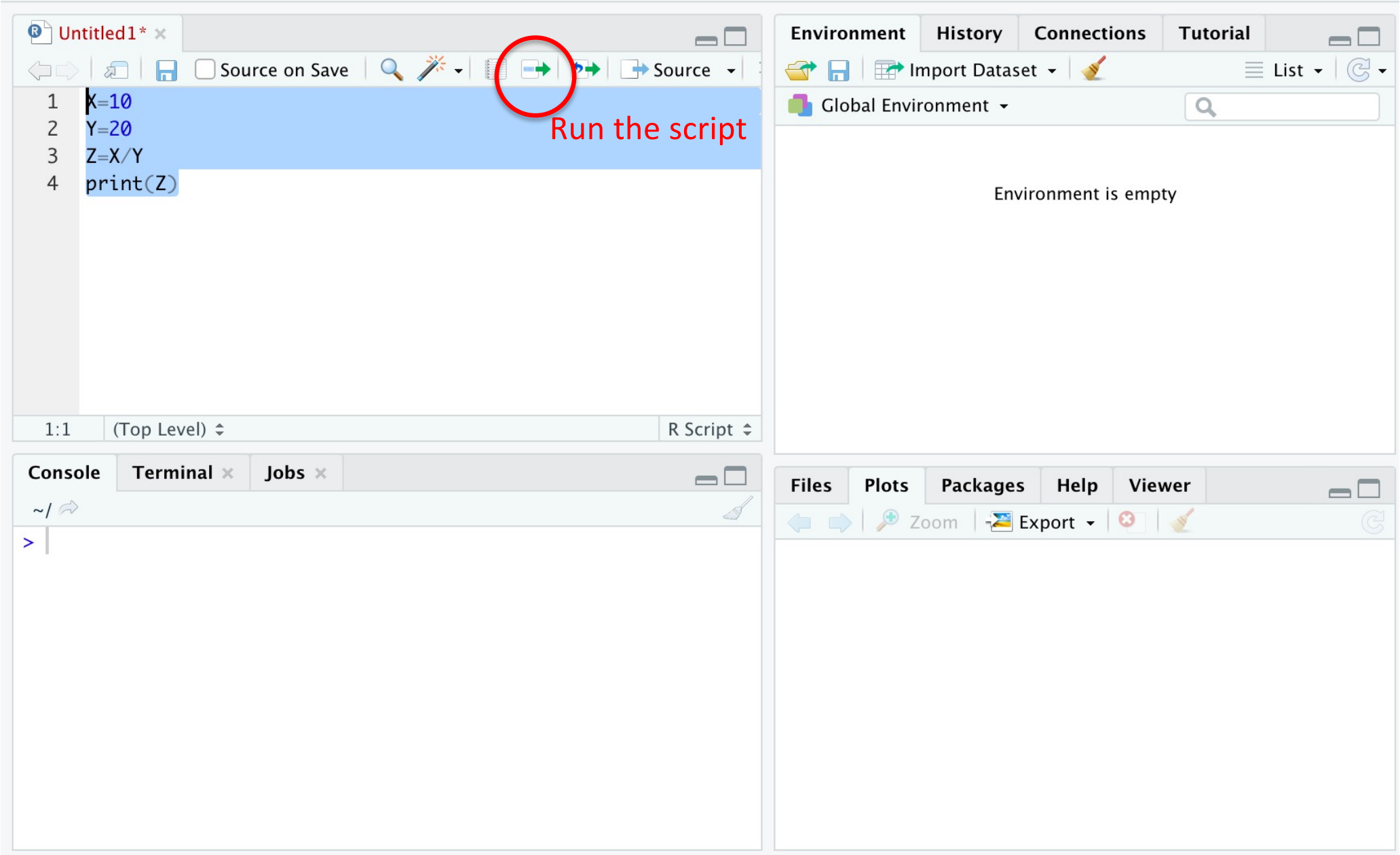
R studio interface



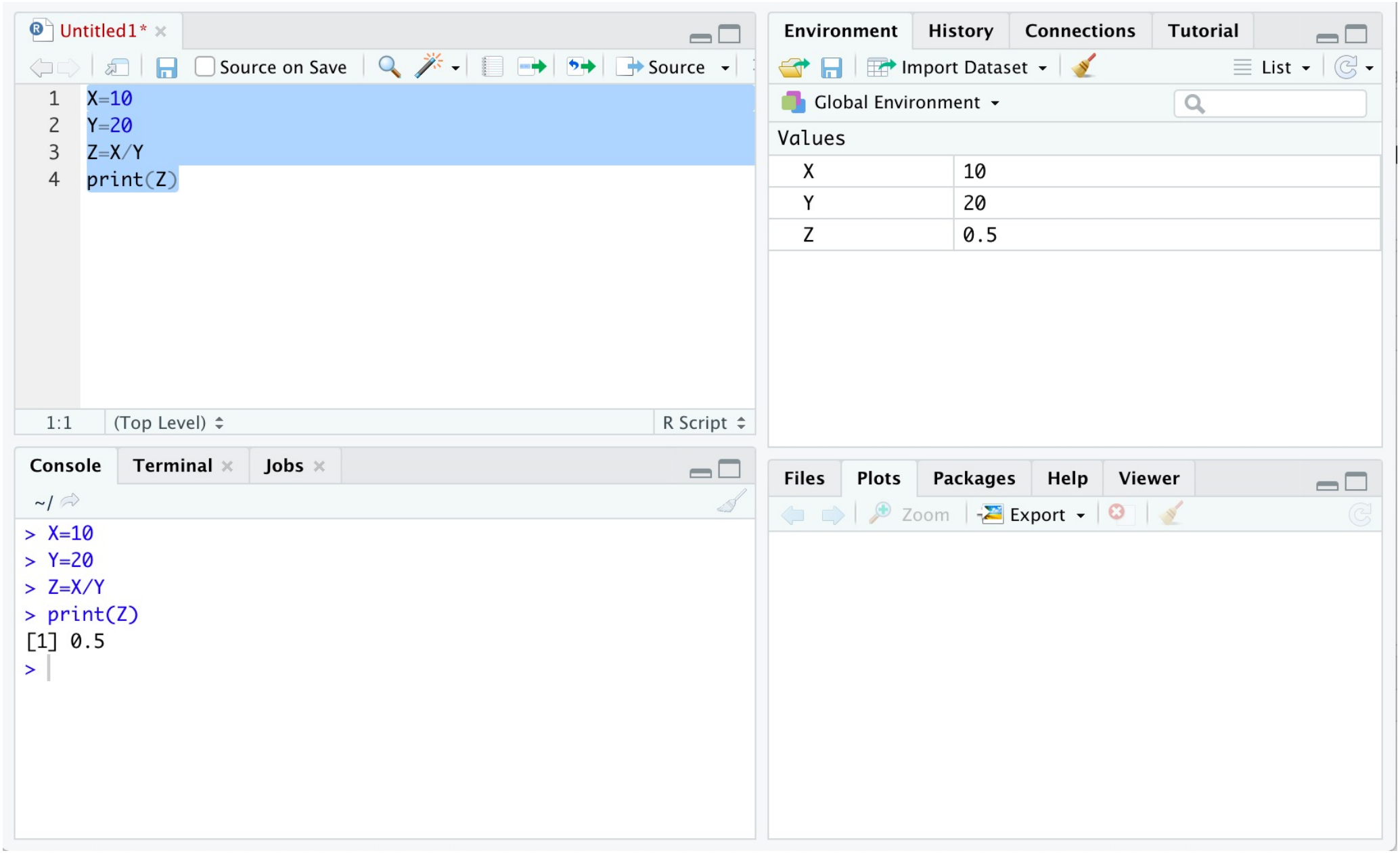
R studio interface



R studio interface



R studio interface



R

- Vector
- Matrix
- Data.frame
- List
- Functions
- Loops
- Conditions
- Graphics
- Linear regression

Vector

```
> X<-c(1,2,3,4)
> X
[1] 1 2 3 4
> X<-1:4
> X
[1] 1 2 3 4
> X<-seq(1,4,by=1)
> X
[1] 1 2 3 4
> X<-seq(1,4,by=0.1)
> X
 [1] 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8 2.9 3.0 3.1
3.2 3.3 3.4 3.5 3.6 3.7 3.8 3.9 4.0
>
```

Vector

```
> X<-c(10,20,50,99,-123)
> X[3]
[1] 50
> X[3:5]
[1]   50   99 -123
> X[c(1,4)]
[1] 10 99
```

Vector

```
X<-1:10
> X
 [1]  1  2  3  4  5  6  7  8  9 10
> Y<-seq(10,1, by=-1)
> Y
 [1] 10  9  8  7  6  5  4  3  2  1
> X+Y
 [1] 11 11 11 11 11 11 11 11 11 11
>  X*Y
 [1] 10 18 24 28 30 30 28 24 18 10
> X%*%Y
     [,1]
[1,]  220
```

Vector of characters

- Vector of texts
- Use `` or ‘

```
x<- c("I","like”,”Lille","very","much")
x
[1] "I"    "like"    ”Lille"   "very"   "much"
```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Matrix

```
> MyNiceMatrix<-matrix(0,nrow=2,ncol=2)
> MyNiceMatrix
     [,1] [,2]
[1,]    0    0
[2,]    0    0
> MyBeautifulMatrix<-matrix(3, nrow=2, ncol=2)
> MyBeautifulMatrix
     [,1] [,2]
[1,]    3    3
[2,]    3    3
> MyWonderfulMatrix<-MyNiceMatrix+MyBeautifulMatrix+12
> MyWonderfulMatrix
     [,1] [,2]
[1,]   15   15
[2,]   15   15
```

data.frame

```
> Location<-c("London","Paris","Madrid")
> Temperature<-c(10,15,22)
> Rating<-c("Awful", "Medium", "OK")
> Weather<-data.frame(Location,Temperature,Rating)
> Weather
>
     Location    Temperature   Rating
1    London      10            Awful
2    Paris       15            Medium
3    Madrid      22            OK
```

data.frame

Important: A data.frame can be created from an external file (.txt, .csv, .xls) using specific functions.

Example:

TAB=read.table(‘filename.txt’, header=T).

list

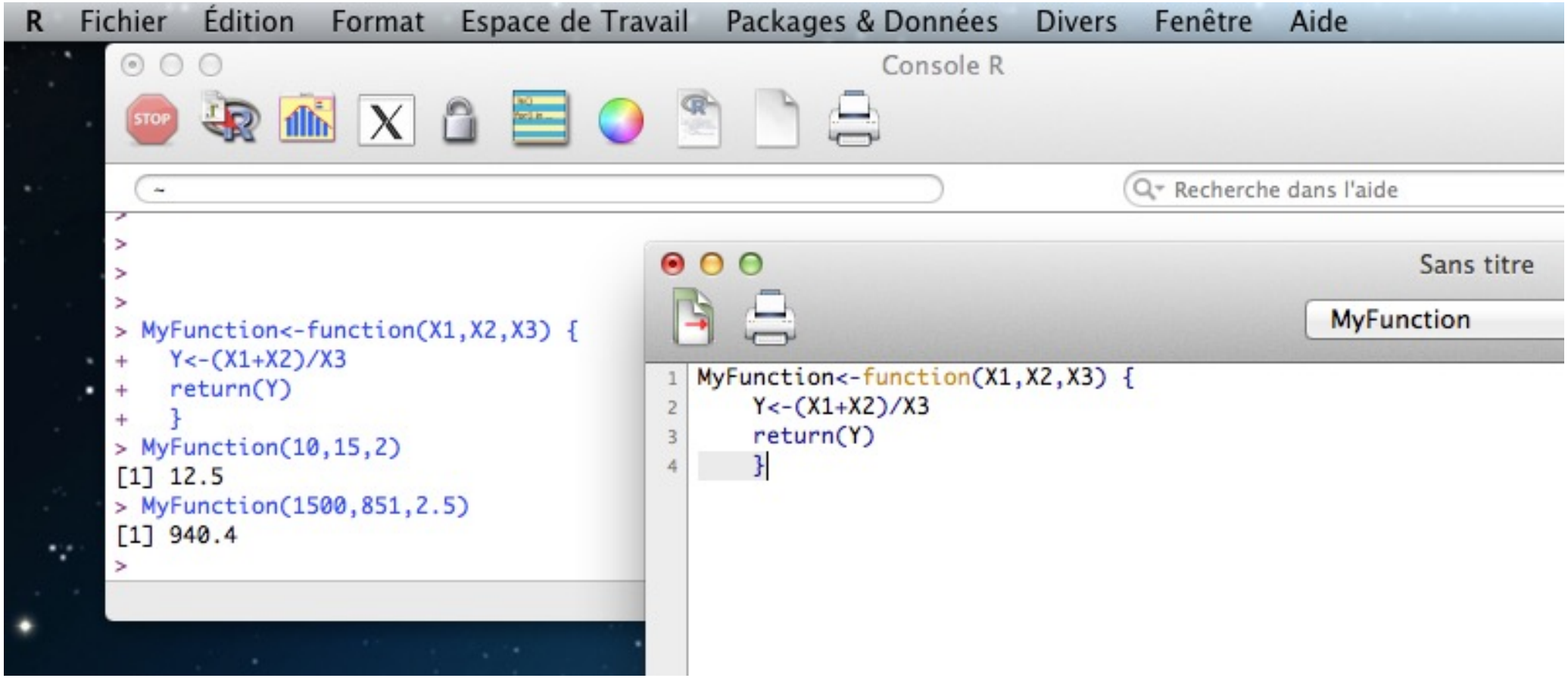
```
> MyList<-list(Location, Temperature, Rating)
> MyList
[[1]]
[1] "London" "Paris"  "Madrid"

[[2]]
[1] 10 15 22

[[3]]
[1] "Awful"  "Medium" "OK"

> MyList[[2]]
[1] 10 15 22
> MyList[[2]][3]
[1] 22
>
```

fonctions

- Existing functions

print(), log(), exp(), plot(), lm() etc.

- New functions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Console R
Recherche dans l'aide
> MyFunction<-function(X1,X2,X3) {
+ Y<-(X1+X2)/X3
+ return(Y)
+ }
> MyFunction(10,15,2)
[1] 12.5
> MyFunction(1500,851,2.5)
[1] 940.4
Sans titre
MyFunction
MyFunction<-function(X1,X2,X3) {
Y<-(X1+X2)/X3
return(Y)
}

Loop: for (i in 1:N) {}

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Console R

```
>
>
> MyFunction<-function(X1,X2,X3) {
+   Y<-(X1+X2)/X3
+   return(Y)
+   }
>
> for (i in 1:10) {
+
+ print(MyFunction(i,20,5))
+
+ }
[1] 4.2
[1] 4.4
[1] 4.6
[1] 4.8
[1] 5
[1] 5.2
[1] 5.4
[1] 5.6
[1] 5.8
[1] 6
>
```

```
MyFunction<-function(X1,X2,X3) {
    Y<-(X1+X2)/X3
    return(Y)
    }

for (i in 1:10) {

print(MyFunction(i,20,5))

}
```

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Console R

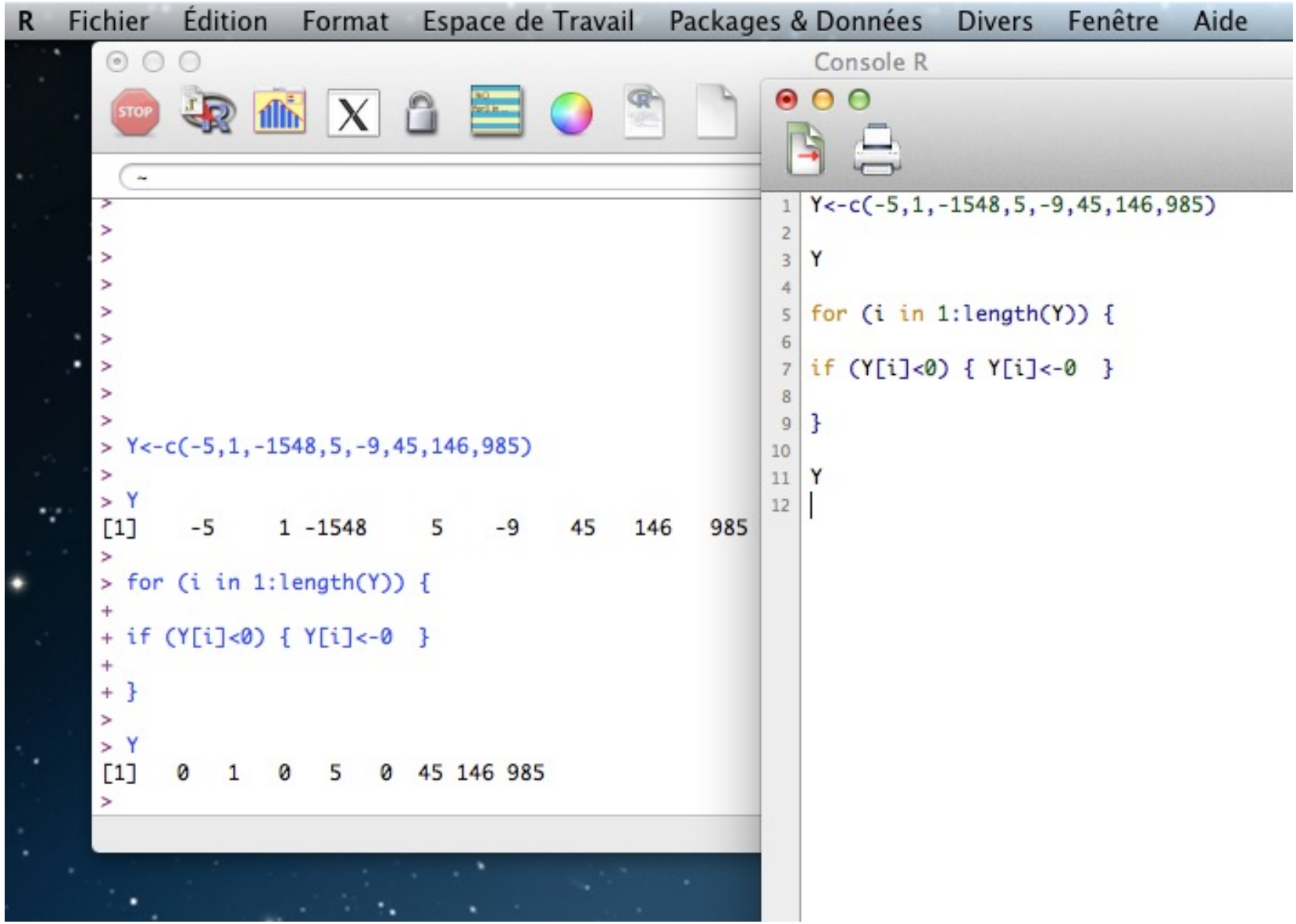
```
>
> MyFunction<-function(X1,X2,X3) {
+   Y<-(X1+X2)/X3
+   return(Y)
+   }
>
> X<-matrix(nrow=10,ncol=1)
> X[,1]<-1:10
>
> apply(X,2,MyFunction,20,5)
      [,1]
 [1,]  4.2
 [2,]  4.4
 [3,]  4.6
 [4,]  4.8
 [5,]  5.0
 [6,]  5.2
 [7,]  5.4
 [8,]  5.6
 [9,]  5.8
[10,]  6.0
>
>
```

```
MyFunction<-function(X1,X2,X3) {
    Y<-(X1+X2)/X3
    return(Y)
    }

X<-matrix(nrow=10,ncol=1)
X[,1]<-1:10

apply(X,2,MyFunction,20,5)
```

conditions: if (test) {}



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```
>
>
>
>
>
>
>
>
> Y<-c(-5,1,-1548,5,-9,45,146,985)
>
> Y
[1]    -5     1 -1548     5    -9    45   146   985
>
> Y[Y<0]<-0
>
> Y
[1]   0   1   0   5   0  45 146 985
>
>
```

```
Y<-c(-5,1,-1548,5,-9,45,146,985)

Y

Y[Y<0]<-0

Y
```

graphics

- Functions for building a new graph

  plot, hist, barplot, etc.

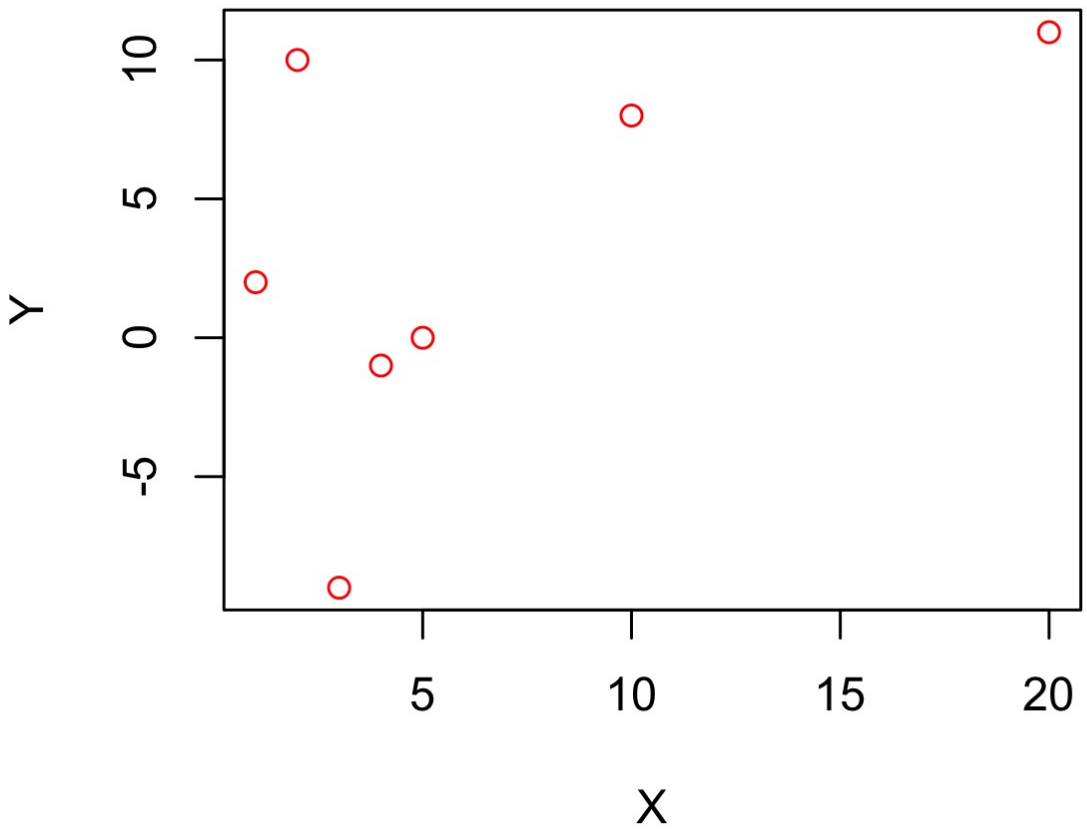
- Functions to add new components to an existing graph

  lines, points, text, abline etc.

```
>
>
>
> X<-c(1,2,3,4,5,10,20)
> Y<-c(2,10,-9,-1,0,8,11)
> plot(X,Y, col="red")
>
```

```
X<-c(1,2,3,4,5,10,20)
Y<-c(2,10,-9,-1,0,8,11)
plot(X,Y, col="red")
```

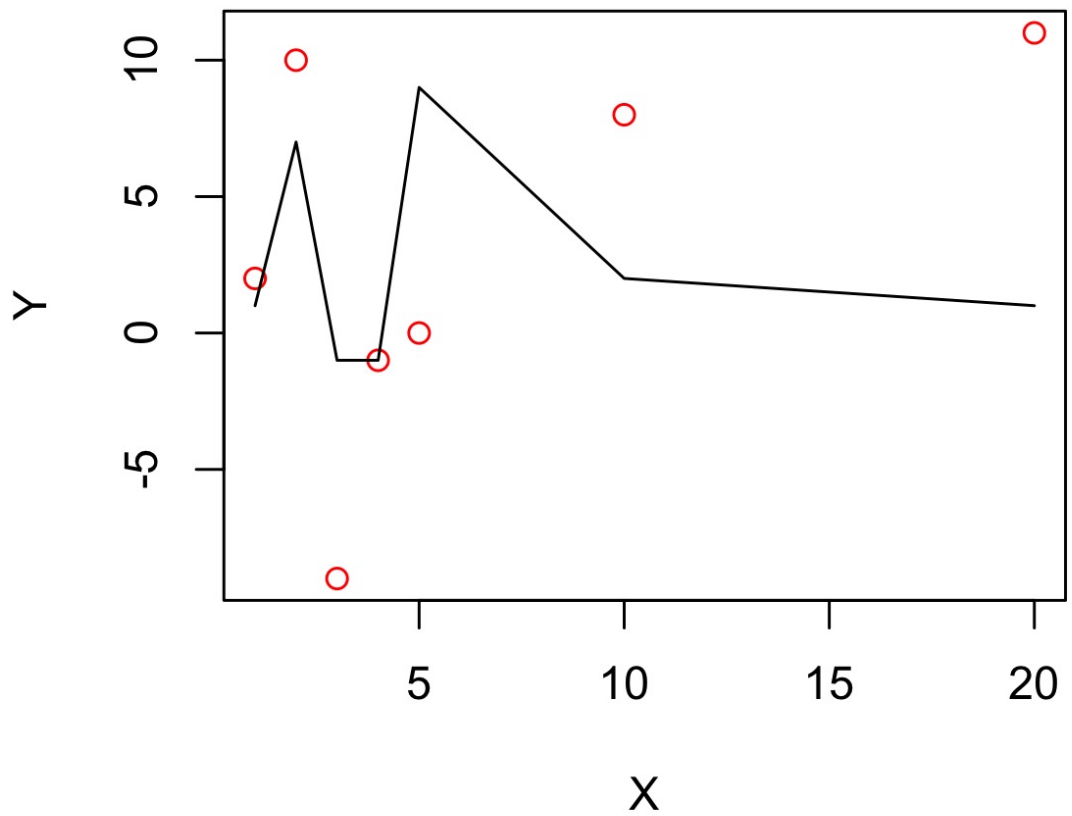
Quartz 2 [*]



```
>
> X<-c(1,2,3,4,5,10,20)
> Y<-c(2,10,-9,-1,0,8,11)
> plot(X,Y, col="red")
> Z<-c(1,7,-1,-1,9,2,1)
> lines(X,Z)
>
```

```
X<-c(1,2,3,4,5,10,20)
Y<-c(2,10,-9,-1,0,8,11)
plot(X,Y, col="red")
Z<-c(1,7,-1,-1,9,2,1)
lines(X,Z)
```

Quartz 2 [*]



Simple mathematical functions

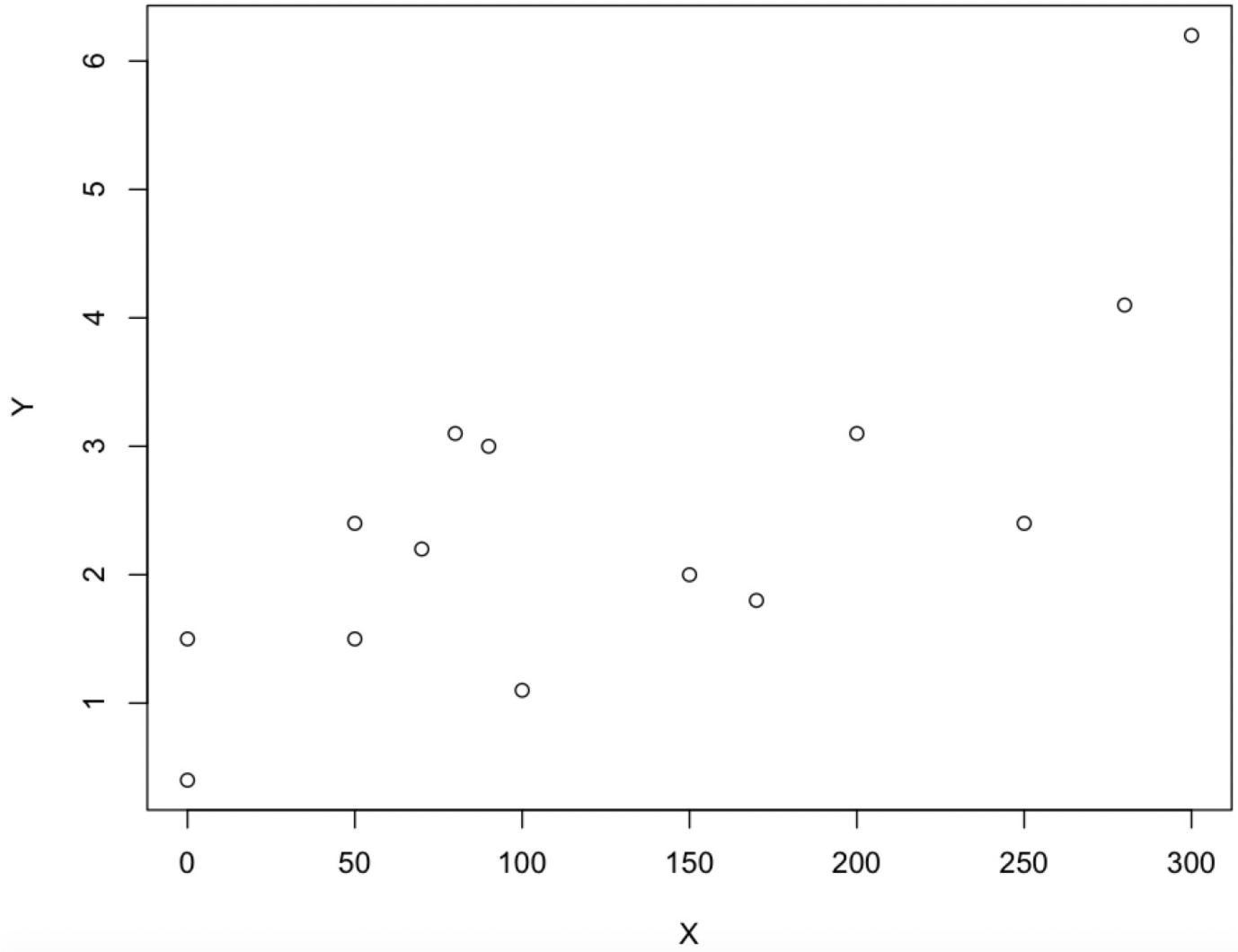
- - + / *
- sum()
- ^2, ^3,…
- log(), exp()
- mean()
- median()
- quantile()
- min(), max()

~/Documents/David/Enseignements/18_FormationOuaga2

Recherche dans l'aide

```
> X<-c(1,2,3,4,5,6,7,8,9,10,11)
> sum(X)
[1] 66
> mean(X)
[1] 6
> median(X)
[1] 6
> quantile(X,0.25)
25%
3.5
> log(X)
 [1] 0.0000000 0.6931472 1.0986123 1.3862944 1.6094379 1.7917595 1.9459101 2.0794415 2.1972246 2.3025851 2.3978953
> exp(X)
 [1]     2.718282     7.389056    20.085537    54.598150   148.413159   403.428793  1096.633158  2980.957987  8103.083928
22026.465795 59874.141715
> X^3
 [1]    1    8   27   64  125  216  343  512  729 1000 1331
> X*10
 [1]  10  20  30  40  50  60  70  80  90 100 110
>
```

Linear regression



```r
#Data
X<-c(0,250,100,50,70,170,300,50,80,90,0,280,200,150)
Y<-c(1.5,2.4,1.1,1.5,2.2,1.8,6.2,2.4,3.1,3.0,0.4,4.1,3.1,2)

#Graphic
plot(X,Y)

#Regression
LinReg<-lm(Y~X)
summary(LinReg)

#Regression line
D<-1:300
Fit<-1.12+0.0106*D
lines(D,Fit,col="red",lwd=2)
```

```
> summary(LinReg)

Call:
lm(formula = Y ~ X)

Residuals:
     Min       1Q   Median       3Q      Max 
-1.38665 -0.72333 -0.08014  0.65167  1.88080 

Coefficients:
            Estimate Std. Error t value Pr(>|t|)   
(Intercept) 1.123915   0.445230   2.524  0.02670 * 
X           0.010651   0.002789   3.818  0.00245 **
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.9973 on 12 degrees of freedom
Multiple R-squared:  0.5485,	Adjusted R-squared:  0.5109 
F-statistic: 14.58 on 1 and 12 DF,  p-value: 0.002446
```