Introduction to R Software

Data Frames

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Data Frames

An example data frame `painters` is available in the library MASS (here only an excerpt of a data set):

```
> library(MASS)
> painters
           Composition Drawing Colour Expression School
Da Udine            10       8     16          3      A
Da Vinci            15      16      4         14      A
Del Piombo           8      13     16          7      A
Del Sarto           12      16      9          8      A
Fr. Penni            0      15      8          0      A
                     .       .      .          .      .
                     .       .      .          .      .
                     .       .      .          .      .
```

Here, the names of the painters serve as row identifications, i.e., every row is assigned to the name of the corresponding painter.

Data Frames

R Console

```
> library(MASS)
> painters
```

	Composition	Drawing	Colour	Expression	School
Da Udine	10	8	16	3	A
Da Vinci	15	16	4	14	A
Del Piombo	8	13	16	7	A
Del Sarto	12	16	9	8	A
Fr. Penni	0	15	8	0	A
Guilio Romano	15	16	4	14	A
⋮	⋮	⋮	⋮	⋮	⋮
Rubens	18	13	17	17	G
Teniers	15	12	13	6	G
Van Dyck	15	10	17	13	G
Bourdon	10	8	8	4	H
Le Brun	16	16	8	16	H

Data Frames

❑ **Attaching a data frame**

With a command `attach()` over the data frame, the variables can be referenced directly by name.

It can address the names of a data frame directly, without the prefix dollar sign operator, e.g. `painters$`.

Example

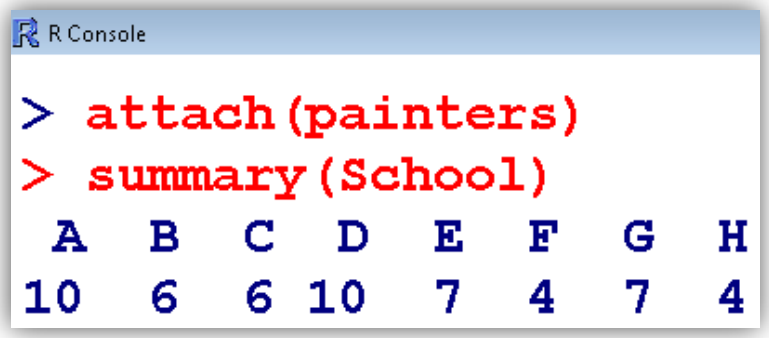
```
> attach(painters)
```

Variable names are

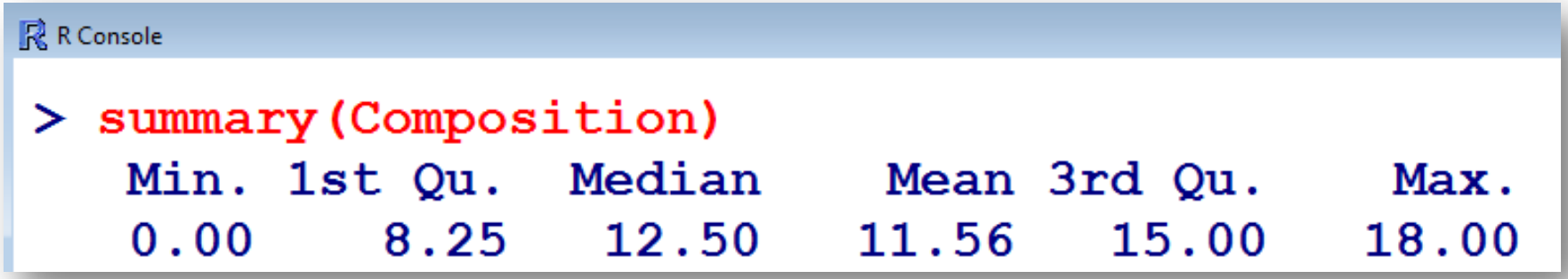
- `Composition,`
- `Drawing,`
- `Colour,`
- `Expression,`
- `School`

Data Frames

```
> summary(School) # Character variable
  A  B  C  D  E  F  G  H
 10  6  6 10  7  4  7  4
```




```
> summary(Composition) # Numeric variable
   Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
   0.00    8.25   12.50   11.56   15.00   18.00
```

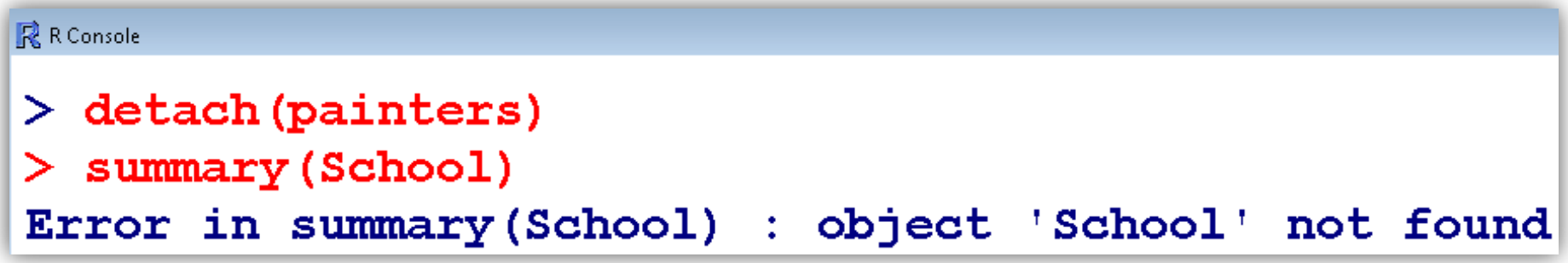


Data Frames

- The command `detach()` recovers the default setting and then we have to use `painters$` again.

```
> detach(painters)

> summary(School)
Error in summary(School) : Object "School" not
found
```



Data Frames

Subsets of a data frame can be obtained with `subset()` or with the second equivalent command:

```
> subset(painters, School=='F')
```

(# == means logical equal sign)

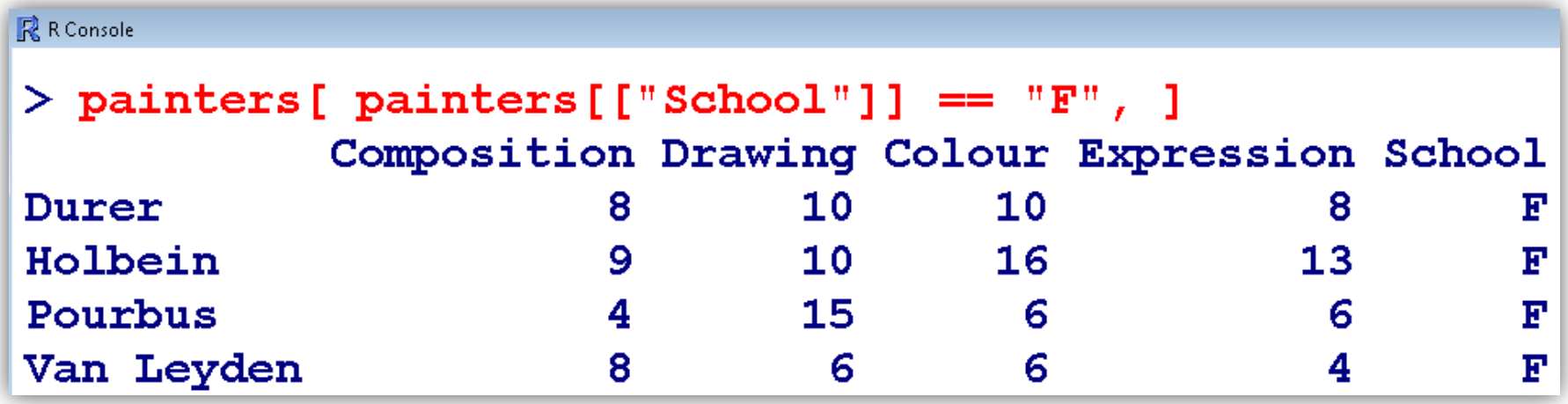
	Composition	Drawing	Colour	Expression	School
Durer	8	10	10	8	F
Holbein	9	10	16	13	F
Pourbus	4	15	6	6	F
VanLeyden	8	6	6	4	F

Data Frames

Similar outcome can be also obtained from

```
> painters[ painters[["School"]] == "F", ]
```

	Composition	Drawing	Colour	Expression	School
Durer	8	10	10	8	F
Holbein	9	10	16	13	F
Pourbus	4	15	6	6	F
VanLeyden	8	6	6	4	F



Data Frames

Subsets of a data frame can be obtained with `subset()` or with the second equivalent command:

```
> subset(painters, Composition <= 6)
```

R Console

```
> subset(painters, Composition <= 6)
             Composition Drawing Colour Expression School
Fr. Penni              0      15      8          0      A
Perugino               4      12     10          4      A
Bassano                6       8     17          0      D
Bellini                4       6     14          0      D
Murillo                6       8     15          4      D
Palma Vecchio          5       6     16          0      D
Caravaggio             6       6     16          0      E
Pourbus                4      15      6          6      F
>
```

Data Frames

- Uninteresting columns can be eliminated.

```
> subset(painters, School=="F", select=c(-3,-5)
            Composition Drawing Expression
Durer                 8      10          8
Holbein               9      10         13
Pourbus               4      15          6
Van Leyden            8       6          4
```

The third and the fifth column (Colour and School) are not shown.

Data Frames

R Console

```
> subset(painters, School=="F", select=c(-3,-5))
            Composition Drawing Expression
Durer                 8      10          8
Holbein               9      10         13
Pourbus               4      15          6
Van Leyden            8       6          4
>
```

Data Frames

- The command split partitions the data set by values of a specific variable. This should preferably be a factor variable.

Example: Following command splits `painters` with respect to `School` (A,B,C,… categories)

```
> splitted <- split(painters, painters$School)
```

Data Frames

```
> splitted
$A
                Composition Drawing Colour Expression School
Da Udine                 10       8     16          3      A
Da Vinci                 15      16      4         14      A
Del Piombo                8      13     16          7      A
Del Sarto                12      16      9          8      A
Fr. Penni                 0      15      8          0      A
Guilio Romano            15      16      4         14      A
Michelangelo              8      17      4          8      A
Perino del Vaga          15      16      7          6      A
Perugino                  4      12     10          4      A
Raphael                  17      18     12         18      A
```

Contd…

R Console

```
> splitted <- split(painters, painters$School)
> splitted
$A
                Composition Drawing Colour Expression School
Da Udine                 10       8     16          3      A
Da Vinci                 15      16      4         14      A
Del Piombo                8      13     16          7      A
Del Sarto                12      16      9          8      A
Fr. Penni                 0      15      8          0      A
Guilio Romano            15      16      4         14      A
Michelangelo              8      17      4          8      A
```

Data Frames

$B

	Composition	Drawing	Colour	Expression	School
F. Zucarro	10	13	8	8	B
Fr. Salviata	13	15	8	8	B
Parmigiano	10	15	6	6	B
Primaticcio	15	14	7	10	B
T. Zucarro	13	14	10	9	B
Volterra	12	15	5	8	B

Contd…

R Console

```
> splitted $B
```

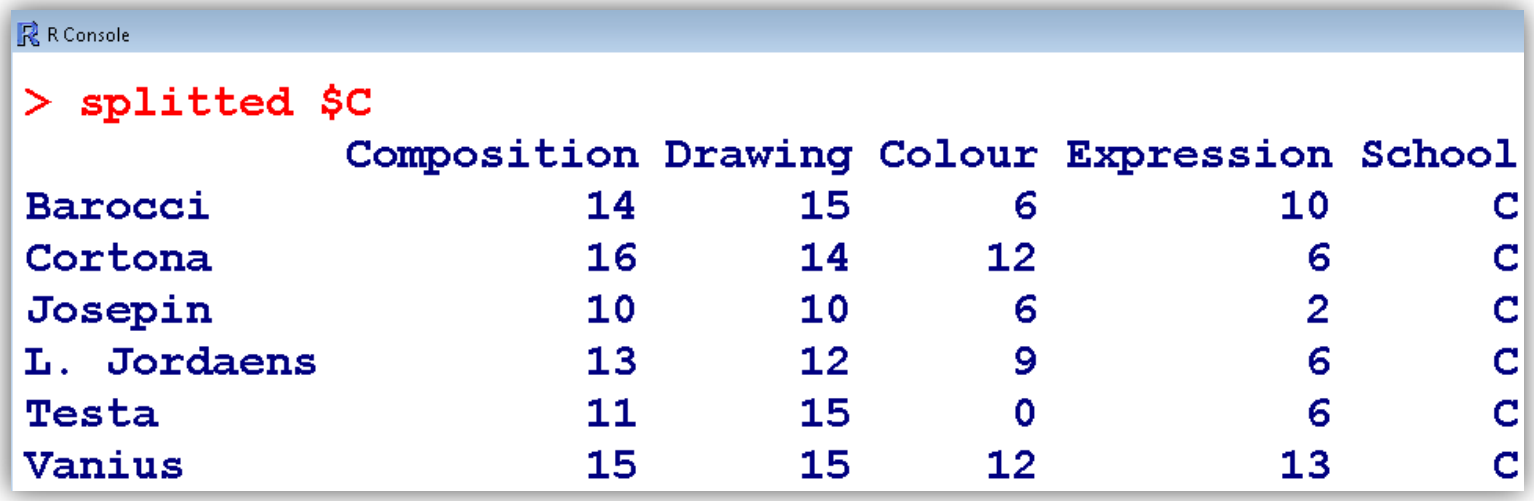
	Composition	Drawing	Colour	Expression	School
F. Zucarro	10	13	8	8	B
Fr. Salviata	13	15	8	8	B
Parmigiano	10	15	6	6	B
Primaticcio	15	14	7	10	B
T. Zucarro	13	14	10	9	B
Volterra	12	15	5	8	B

Data Frames

$C

	Composition	Drawing	Colour	Expression	School
Barocci	14	15	6	10	C
Cortona	16	14	12	6	C
Josepin	10	10	6	2	C
L. Jordaens	13	12	9	6	C
Testa	11	15	0	6	C
Vanius	15	15	12	13	C

Contd…



Data Frames

Contd…

```
. . .
$H
          Composition Drawing Colour Expression School
Bourdon             10       8      8          4      H
Le Brun             16      16      8         16      H
Le Suer             15      15      4         15      H
Poussin             15      17      6         15      H
```

R Console

```
> splitted $H
          Composition Drawing Colour Expression School
Bourdon             10       8      8          4      H
Le Brun             16      16      8         16      H
Le Suer             15      15      4         15      H
Poussin             15      17      6         15      H
```

Remark: If the data set is not attached, we have to use

`painters$School.`

Data Frames

The objects `splitted$A` to `splitted$H` are themselves data frames:

```
> is.data.frame(splitted$A)
[1] TRUE
```