Importing and working with data in RStudio

Advanced Psychological Research Methods

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By the end of this section, you will be able to:

- Import data into R from excel, SPSS and csv files
- Identify different data structures and variable types
- Convert variables from one type to another
- Order, filter and group data
- Summarise data
- Create new variables from data

The *Tidyverse* set of packages

- A ‘toolkit’ of packages that are very useful for organsing and manipulating data
- We will use the *haven* package to import SPSS files
- We will use the *dplyr* to organise data
- Also includes the *ggplot2* and *tidyR* packages which we will use later

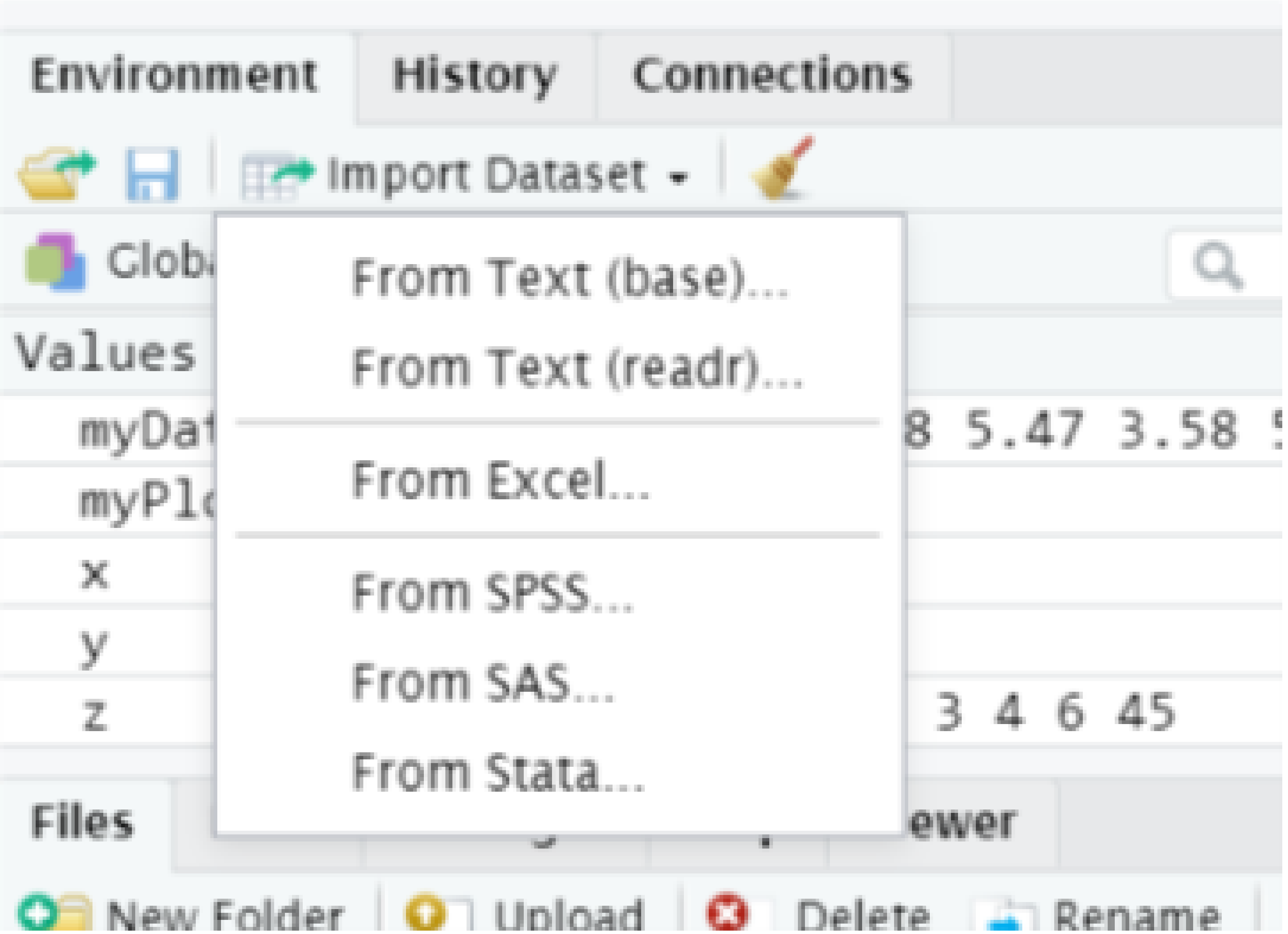
To install:

```
install.packages("tidyverse")
```

Importing .csv data into R

- Can use typed commands or the menu:

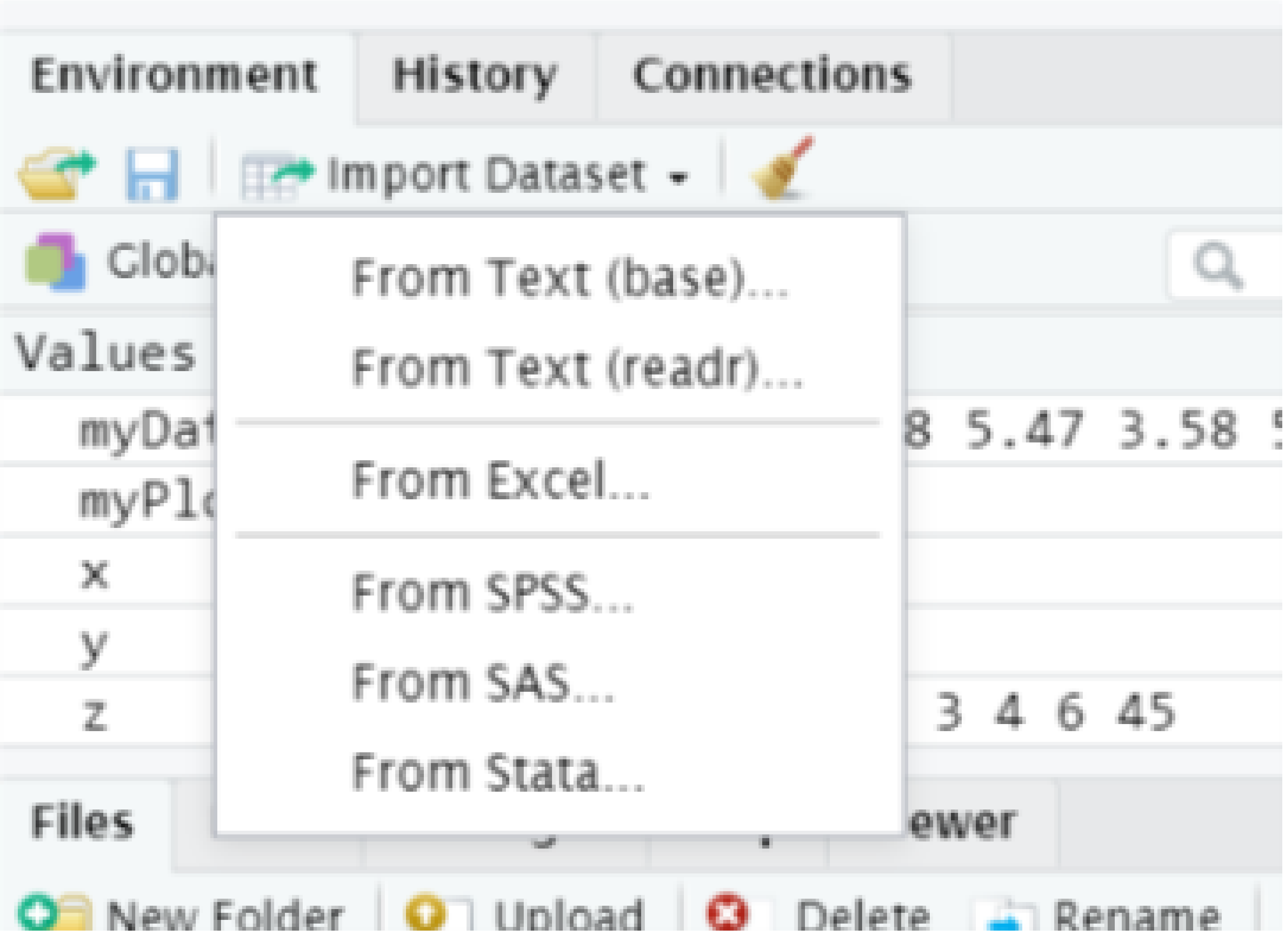
```r
library(readr)
studentData <- read_csv("Datasets/studentData.csv")
```



Importing SPSS data files into R

- Can use typed commands or the menu:

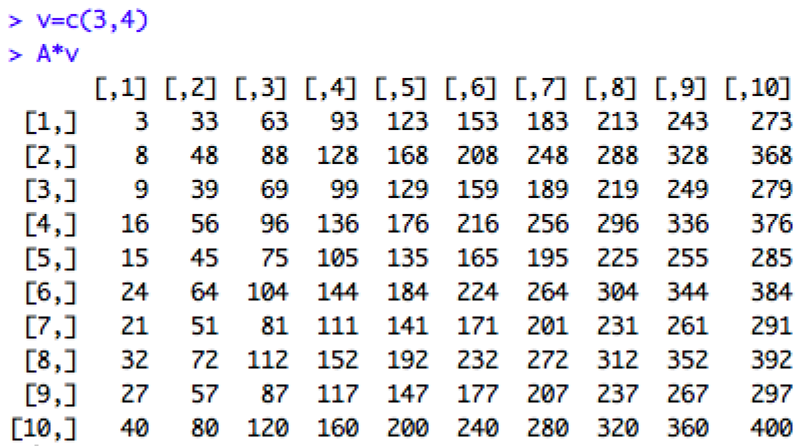
```
library(haven)
 mySPSSData <- read_sav("mySPSSFile.sav")
```



R can store many different data types

- Vectors: One-dimensional
- Data frames: Two-dimensional
- Matrices: Two-dimensional
- Arrays, Lists etc…

A data matrix:



```
> v=c(3,4)
> A*v
      [,1] [,2] [,3] [,4] [,5] [,6] [,7] [,8] [,9] [,10]
 [1,]    3   33   63   93  123  153  183  213  243   273
 [2,]    8   48   88  128  168  208  248  288  328   368
 [3,]    9   39   69   99  129  159  189  219  249   279
 [4,]   16   56   96  136  176  216  256  296  336   376
 [5,]   15   45   75  105  135  165  195  225  255   285
 [6,]   24   64  104  144  184  224  264  304  344   384
 [7,]   21   51   81  111  141  171  201  231  261   291
 [8,]   32   72  112  152  192  232  272  312  352   392
 [9,]   27   57   87  117  147  177  207  237  267   297
[10,]   40   80  120  160  200  240  280  320  360   400
```

The data frame

- A data frame is like a table or a two-dimensional array or matrix
- Each column contains values of one variable
- Each row contains one set of values
- Each column name must be unique

...1	route	grades	hoursOfStudy	hasDepdendants	satisfactionLevel
1	FullTime	56	3	Yes	Very
2	FullTime	47	1	Yes	Not at all
3	FullTime	72	8	Yes	Not at all
4	FullTime	79	0	Yes	Very
5	FullTime	79	4	Yes	Somewhat
6	FullTime	80	3	Yes	Somewhat

Checking the structure of the data

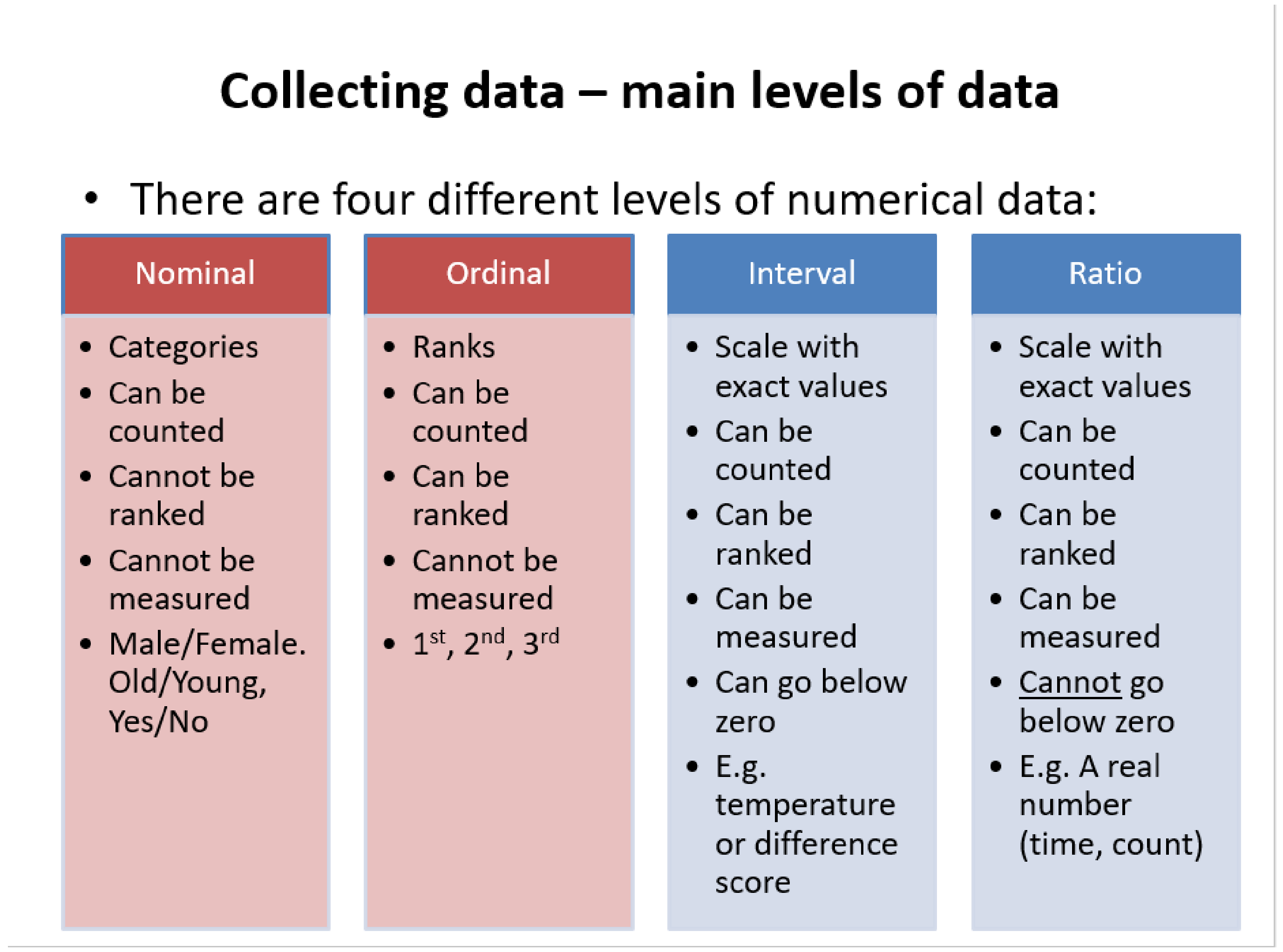
- The **str()** command will allow us to check how our data is structured:

```
str(studentData)
```

```
spec_tbl_df [100 × 6] (S3: spec_tbl_df/tbl_df/tbl/data.frame)
 $ ...1             : num [1:100] 1 2 3 4 5 6 7 8 9 10 ...
 $ route            : chr [1:100] "FullTime" "FullTime" "FullTime" "FullTime" ...
 $ grades           : num [1:100] 56 47 72 79 79 80 76 39 85 41 ...
 $ hoursOfStudy     : num [1:100] 3 1 8 0 4 3 1 6 2 5 ...
 $ hasDepdendants   : chr [1:100] "Yes" "Yes" "Yes" "Yes" ...
 $ satisfactionLevel: chr [1:100] "Very" "Not at all" "Not at all" "Very" ...
 - attr(*, "spec")=
  .. cols(
  ..   ...1 = col_double(),
  ..   route = col_character(),
  ..   grades = col_double(),
  ..   hoursOfStudy = col_double(),
  ..   hasDepdendants = col_character(),
  ..   satisfactionLevel = col_character()
  .. )
```

Notice that some of the variable types are incorrect

Changing variables from one data type to another



Collecting data – main levels of data

- There are four different levels of numerical data:

Nominal	Ordinal	Interval	Ratio
• Categories • Can be counted • Cannot be ranked • Cannot be measured • Male/Female. Old/Young, Yes/No	• Ranks • Can be counted • Can be ranked • Cannot be measured • 1st, 2nd, 3rd	• Scale with exact values • Can be counted • Can be ranked • Can be measured • Can go below zero • E.g. temperature or difference score	• Scale with exact values • Can be counted • Can be ranked • Can be measured • Cannot go below zero • E.g. A real number (time, count)

```r
studentData$route <- as.factor(studentData$route)
studentData$hasDepdendants <- as.factor(studentData$hasDepdendants)
studentData$satisfactionLevel <- as.ordered(studentData$satisfactionLevel)
```

The code above changes the variables so that R recognises them as factors (nominal) or ordered factors (ordinal) variables

Changing variables from one data type to another #2

Let’s check the structure again:

```r
str(studentData)
```

```
spec_tbl_df [100 × 6] (S3: spec_tbl_df/tbl_df/tbl/data.frame)
 $ ...1             : num [1:100] 1 2 3 4 5 6 7 8 9 10 ...
 $ route            : Factor w/ 2 levels "FullTime","PartTime": 1 1 1 1 1 1 1 1 1 1 ...
 $ grades           : num [1:100] 56 47 72 79 79 80 76 39 85 41 ...
 $ hoursOfStudy     : num [1:100] 3 1 8 0 4 3 1 6 2 5 ...
 $ hasDepdendants   : Factor w/ 2 levels "No","Yes": 2 2 2 2 2 2 2 2 2 2 ...
 $ satisfactionLevel: Ord.factor w/ 3 levels "Not at all"<"Somewhat"<..: 3 1 1 3 2 2 3 2 1 2 ...
 - attr(*, "spec")=
  .. cols(
  ..   ...1 = col_double(),
  ..   route = col_character(),
  ..   grades = col_double(),
  ..   hoursOfStudy = col_double(),
  ..   hasDepdendants = col_character(),
  ..   satisfactionLevel = col_character()
  .. )
```

```r
str(studentData$satisfactionLevel)
```

```
 Ord.factor w/ 3 levels "Not at all"<"Somewhat"<..: 3 1 1 3 2 2 3 2 1 2 ...
```

Changing variables from one data type to another #3

Let’s give a proper name to the row ID:

```r
#Overwriting studentData with a new version, where the ID column has been correctly named
studentData <- studentData %>% rename(ID = ...1)
head(studentData) # viewing the first 5 rows of the data
```

```
# A tibble: 6 × 6
     ID route    grades hoursOfStudy hasDepdendants satisfactionLevel
  <dbl> <fct>     <dbl>        <dbl> <fct>          <ord>
1     1 FullTime     56            3 Yes            Very
2     2 FullTime     47            1 Yes            Not at all
3     3 FullTime     72            8 Yes            Not at all
4     4 FullTime     79            0 Yes            Very
5     5 FullTime     79            4 Yes            Somewhat
6     6 FullTime     80            3 Yes            Somewhat
```

Sorting data #1

- Using the *dplyr* package, we can arrange our data according to student grade:

```r
arrange(studentData, grades)
```

```
# A tibble: 100 × 6
      ID route    grades hoursOfStudy hasDepdendants satisfactionLevel
   <dbl> <fct>     <dbl>        <dbl> <fct>          <ord>
 1    64 PartTime     35            7 No             Somewhat
 2    93 PartTime     36            8 No             Somewhat
 3    25 FullTime     37            7 Yes            Not at all
 4    39 FullTime     37            2 Yes            Somewhat
 5    46 FullTime     37            6 Yes            Very
 6    61 PartTime     38            2 No             Somewhat
 7     8 FullTime     39            6 Yes            Somewhat
 8    31 FullTime     39            4 Yes            Somewhat
 9    58 PartTime     39            7 No             Very
10    67 PartTime     40            6 No             Not at all
# … with 90 more rows
# ℹ Use `print(n = ...)` to see more rows
```

Sorting data #1

- Using the *dplyr* package, we can arrange our data according to student grade:

```r
arrange(studentData, desc(grades)) # Arrange in descending order
```

```
# A tibble: 100 × 6
      ID route    grades hoursOfStudy hasDepdendants satisfactionLevel
   <dbl> <fct>     <dbl>        <dbl> <fct>          <ord>
 1     9 FullTime     85            2 Yes            Not at all
 2    43 FullTime     85            0 Yes            Somewhat
 3    59 PartTime     85            4 No             Very
 4    76 PartTime     83            6 No             Not at all
 5    48 FullTime     82            6 Yes            Not at all
 6    68 PartTime     82            6 No             Very
 7    71 PartTime     82            4 No             Somewhat
 8    12 FullTime     81            8 Yes            Not at all
 9    74 PartTime     81            5 No             Very
10     6 FullTime     80            3 Yes            Somewhat
# … with 90 more rows
# ℹ Use `print(n = ...)` to see more rows
```

Filtering data

- Show students who acheived a grade of less than 40%

```
filter(studentData, grades < 40)
```

```
# A tibble: 9 × 6
     ID route    grades hoursOfStudy hasDepdendants satisfactionLevel
  <dbl> <fct>     <dbl>        <dbl> <fct>          <ord>
1     8 FullTime     39            6 Yes            Somewhat
2    25 FullTime     37            7 Yes            Not at all
3    31 FullTime     39            4 Yes            Somewhat
4    39 FullTime     37            2 Yes            Somewhat
5    46 FullTime     37            6 Yes            Very
6    58 PartTime     39            7 No             Very
7    61 PartTime     38            2 No             Somewhat
8    64 PartTime     35            7 No             Somewhat
9    93 PartTime     36            8 No             Somewhat
```

Filtering data #2

- Show part-time students who scored above 70%

```r
filter(studentData, grades > 70 & route == "PartTime")
```

```
# A tibble: 17 × 6
      ID route    grades hoursOfStudy hasDepdendants satisfactionLevel
   <dbl> <fct>     <dbl>        <dbl> <fct>          <ord>
 1    52 PartTime     72            4 No             Very
 2    59 PartTime     85            4 No             Very
 3    60 PartTime     73            2 No             Very
 4    62 PartTime     80            0 No             Somewhat
 5    68 PartTime     82            6 No             Very
 6    69 PartTime     74            7 No             Very
 7    71 PartTime     82            4 No             Somewhat
 8    73 PartTime     75            8 No             Very
 9    74 PartTime     81            5 No             Very
10    75 PartTime     75            1 No             Very
11    76 PartTime     83            6 No             Not at all
12    78 PartTime     77            0 No             Very
13    81 PartTime     77            7 No             Somewhat
```

Using the “pipe” %>% to link steps of code

- part of the tidyverse package
- The pipe %>% allows us to:
  - write R commands in a way that is easier to read
  - Chain multiple commands together
- For example:

```r
filteredData <- filter(studentData, grades > 70 & route == "PartTime")


filteredData <- studentData %>% filter(grades > 70 & route == "PartTime")
```

Grouping data

- It is possible to organise the data into groups and performe analysis on each group:

```
studentData %>% group_by(hasDepdendants) %>%
  summarise(mean = mean(grades), sd = sd(grades))
```

```
# A tibble: 2 × 3
  hasDepdendants  mean    sd
  <fct>          <dbl> <dbl>
1 No              62.4  14.3
2 Yes             62.3  14.8
```

Remember: we can store that summary data as an object and call it later:

```r
summaryTable <- studentData %>% group_by(hasDepdendants) %>%
  summarise(mean = mean(grades), sd = sd(grades))

summaryTable
```

```
# A tibble: 2 × 3
  hasDepdendants  mean    sd
  <fct>          <dbl> <dbl>
1 No              62.4  14.3
2 Yes             62.3  14.8
```

Create new variables from data

We can create new variables from existing data using **mutuate**

```
studentData %>% mutate(passFail = ifelse(grades > 40, "Pass", "Fail"))
```

```
# A tibble: 100 × 7
      ID route    grades hoursOfStudy hasDepdendants satisfactionLevel passFail
   <dbl> <fct>     <dbl>        <dbl> <fct>          <ord>             <chr>
 1     1 FullTime     56            3 Yes            Very              Pass
 2     2 FullTime     47            1 Yes            Not at all        Pass
 3     3 FullTime     72            8 Yes            Not at all        Pass
 4     4 FullTime     79            0 Yes            Very              Pass
 5     5 FullTime     79            4 Yes            Somewhat          Pass
 6     6 FullTime     80            3 Yes            Somewhat          Pass
 7     7 FullTime     76            1 Yes            Very              Pass
 8     8 FullTime     39            6 Yes            Somewhat          Fail
 9     9 FullTime     85            2 Yes            Not at all        Pass
10    10 FullTime     41            5 Yes            Somewhat          Pass
# … with 90 more rows
# ℹ Use `print(n = ...)` to see more rows
```

Importing and Working with data in R – Tasks:

Importing and Working with data in R

0. Install the **tidyverse** package. When this has been done, enter the command **library("tidyverse")**
1. Use the **read.sav()** command to import the **"Datasets/salesData.sav"** file to a new object called **salesData**
2. Use the **str()** command to check the structure of **salesData** . There should be 5 variables: salary, married, numberOfVisits, age & valueOfSales
3. Change the variable **married** to a factor
4. Arrange the data from lowest to highest **sales** . What was the lowest **sales** value?
5. What is the mean **salary** ?
6. Filter the data to only display customers who are **married** (1 = married, 2 = not married)
7. Create a summary of the data to compare the mean and standard deviation of **sales** for married and non-married customers (1 = married, 2 = not married)
8. Create a new variable called **VIP** and label customers who spent over ?500 as "VIP" and other customers as "Non-VIP"