# SG1022 Seminar 3: Using survey data

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## Objectives

- Getting (local) data into R
- Working with factors (categorical data)
- Using R to analyse surveys (cross-tabs, $X^2$, grouped bar plots)
- Setting up Qualtrics
- Critique survey design

## Pop Quiz

- What is the `min-max` function and why would you use it when creating composite indicators?
- What is the `library` function and when do you use it?

## File paths

Files are organised **hierarchically** into (upside down) trees.

```
Root
|_
    Parent
    |_
        Child1
        Child2
```

## Example file path

The file path `C:\group_project\data\data_set.csv` represents the tree:

```
C
|_
    group_project
    |_
        data
        |_
            data_set.csv
```

## Root

**Root** directories are the **first level of a disk**.

They are the root out of which the file tree grows.

**Root naming conventions**:

**Linux/Mac**: `/`

- e.g. `/group_project` means that the `group_project` directory is a child of the root directory.

**Windows**: the disk is partitioned, e.g. the `C` partition is denoted `C:\`.

- `C:\group_project` indicates that the `group_project` directory is a child of the `C` partition.

## Sub (child) directories

Sub (child) directories are denoted with a `/` in Linux/Mac and `\` in Windows, e.g.:

```
# Linux/Mac
/group_project/data
```

```
# Windows
C:\group_project\data
```

**R tip**:

- In R for Windows you either use two backslashes `\\` (`\` is the R escape character)
- Or `/` in **relative paths** in R for Windows, it will know what you mean.

## Working directories

A **working directory** is the directory where the program looks for files/other directories.

**Always remember the working directory.**

- Otherwise you may open/save files that you do not want to open/save.

## Working directories

**In R:**

```
# Find working directory
getwd()
```

```
## [1] "/git_repositories/city_sg1022/seminars/week_3"
```

```r
# List all files in the working directory
list.files()
```

```
## [1] "ESS5_UKonly.sav" "example_kw.csv"  "seminar_3.html"  "seminar_3.pdf"
## [5] "seminar_3.Rmd"
```

```r
# Set group project as working directory
setwd('C:\\group_project')
```

## Relative vs. Absolute file paths

Use **relative file paths** when possible.

- **Absolute file path**: the entire path on a particular system,
  - E.g. `C:\\group_project/data/data_set.csv`
- **Relative file path**: the path relative to the working directory.
  - E.g. if `C:\\group_project` is the working directory then the relative path for `data_set.csv` is `data/data_set.csv`.

Why?

- Your scripts will run easily on **other computers**. **Enhances reproducibility**. Easier for your collaborators. Easier for you when you use another computer.

## File & directory name conventions

**Don't use spaces** in your file names.

They can create problems for programs that treat spaces as an indication that the path has ended.

Alternatives:

- `CamelCase` (ex. `DataAnalysis.R`)
- `file_underscore` (ex. `data_analysis.R`)

## Loading data into R

R can load data from many different file formats (e.g. `.sav` (SPSS), `.xlsx` (Excel), `.dta` (Stata), `.csv`).

The rio (R input/output) package makes it very easy to import many different types of data.

It has two key functions `import` and `export`.

**Remember:** You will need to `install.packages` rio and then load it into your workspace with `library`.

### Rio `import` for loading data into R

**First**, download the `ESS5_UKonly.sav` data set from Moodle (it's under Week 3). Create a folder called `sg1022_data` and place the data file into it.

**Second**, set your working directory to the folder where the data is located. For example, if your data is in `C:\\sg1022_data` then use:

```
setwd('C:\\sg1022_data/')
```

### Rio `import` for loading data into R

Now load the data using the file's name (`ESS5_UKonly.sav`)

```
library(rio)

# Load ESS 5 (UK) only data from SPSS format
ess5_uk <- import('ESS5_UKonly.sav')

# Show a selection of the data.
head(ess5_uk[1:3, 1:6])
```

```
##        name essround edition   proddate     idno          cntry
## 1 ESS5e03_1        5     3.1 29.04.2014 10100034 United Kingdom
## 2 ESS5e03_1        5     3.1 29.04.2014 10100059 United Kingdom
## 3 ESS5e03_1        5     3.1 29.04.2014 10100067 United Kingdom
```

## Note: Always look at the data you imported to see if it's what you think you imported/see what needs cleaning.

### Rio `export` for saving data

We can save the `ess5_uk` data into another format. For example, .csv "Comma Separated Values". Just add the csv file extension to the file name and `rio` does the rest.

```
export(ess5_uk, 'ess5_uk.csv')
```

### Review: factors (categorical data)

In R, categorical data is coded using **factors**.

Let's load a simple data set into R for this example: `example_kw.csv`.

This file is located on Moodle (Week 3) . Download it and place it into your `sg1022_data` directory. Now load it into a new object called `example`.

```
example <- import('example_kw.csv')
```

## Review: factors (categorical data)

This data set has a numeric variable called `income`. We want to convert it to a factor with three category labels:

| Number Code | Label |
|---|---|
| 1 | Low income |
| 2 | Medium income |
| 3 | High income |

## Factor labels

To convert this variable to a factor and add labels use the `factor` function.

```
# Create a vector of level labels
income_labels <- c('Low income', 'Medium income', 'High income')

# Convert income to factor and apply labels
example$income <- factor(example$income,
                         labels = income_labels)

# Create simple frequency table
summary(example$income)
```

```
##    Low income Medium income   High income
##           495           399           106
```

## Converting from character strings to factors (1)

Sometimes you have data that is in character strings (R sees letters, but doesn't see any categories), but you want it to be a factor. For example:

```
summary(example$kanye_or_wiz)
```

```
##    Length     Class      Mode
##      1000 character character
```

## Converting from character strings to factors (2)

Simply run it through `as.factor`. R will turn it into a factor and use the character strings as factor labels.

```
example$kanye_or_wiz <- as.factor(example$kanye_or_wiz)

summary(example$kanye_or_wiz)
```

```
## kanye   wiz
##   640   360
```

## Frequency table (categorical variables)

Remember, use `summary` to create a basic frequency table of a factor variable in R.

```r
income_freq <- summary(example$income)
income_freq
```

```
##    Low income Medium income   High income
##           495           399           106
```

We can convert these counts to proportions with `prop.table`:

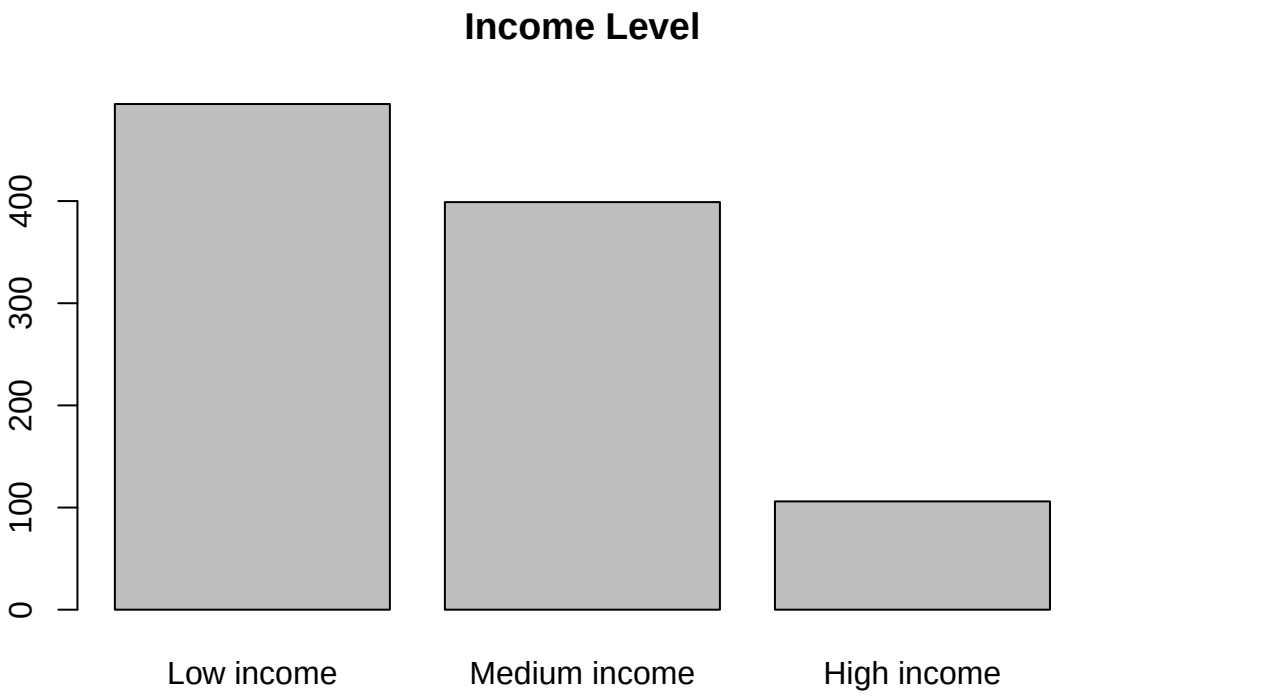
```r
income_prop <- prop.table(income_freq)
income_prop
```

```
##    Low income Medium income   High income
##         0.495         0.399         0.106
```

### Barplot (frequencies)

Show the frequencies more effectively with a barplot. To create a barplot of a single factor variable just use `plot`:

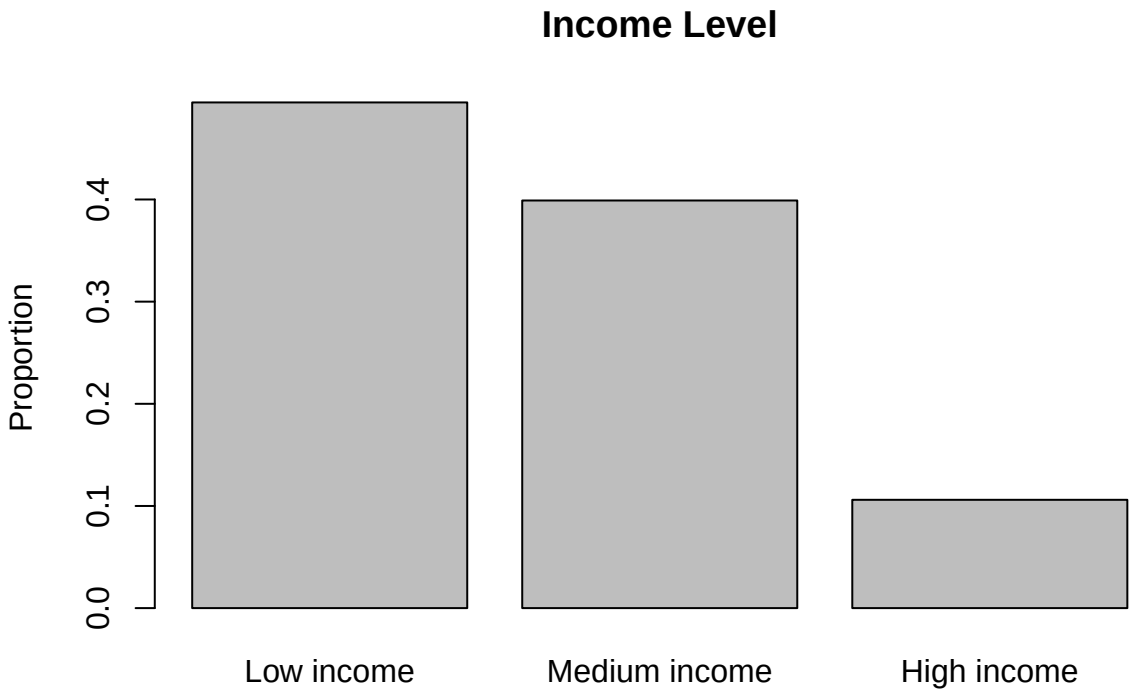
```r
plot(example$income, main = 'Income Level')
```




### Barplot (proportions)

You can also plot the proportions you created before. This time you need to explicitly use `barplot`.

```r
barplot(income_prop, main = 'Income Level', ylab = 'Proportion')
```




### Joint distributions (categorical variables)

Use `table` to create a simple contingency table:

```
support <- table(example$kanye_or_wiz, example$income)
support
```

```
##
##         Low income Medium income High income
##   kanye        311           260          69
##   wiz          184           139          37
```

**Note:** the contingency table you create with the `table` function **is the basis for all** of the following cross-tabs, barplots, and $X^2$ tests.

### Cross-tabs with proportions

Use `prop.table` again to find the contingency table proportions:

```
prop.table(support, margin = 1) # row proportions
```

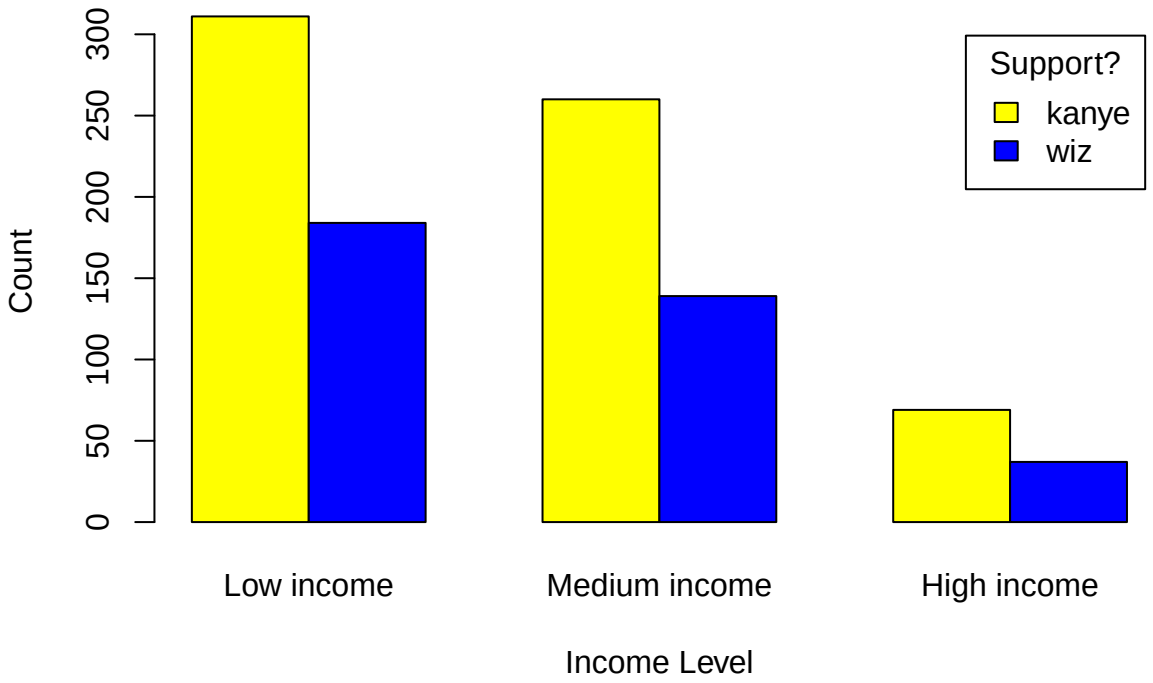
```
##
##         Low income Medium income High income
##   kanye  0.4859375     0.4062500   0.1078125
##   wiz    0.5111111     0.3861111   0.1027778
```

```r
prop.table(support, margin = 2) # column proportions
```

```
##
##         Low income Medium income High income
##   kanye  0.6282828     0.6516291   0.6509434
##   wiz    0.3717172     0.3483709   0.3490566
```

### Plotting (grouped bar chart)–Base R

```r
barplot(support, beside = TRUE, col = c('yellow', 'blue'),
  xlab = 'Income Level', ylab = 'Count',
  legend = rownames(support), args.legend = list(title = 'Support?'))
```




### Colours in R

For a list of R colour names see: http://www.stat.columbia.edu/~tzheng/files/Rcolor.pdf

### Plotting Percentages–Base R (1)

To plot proportions (easier for cross-group comparability), first create a table of the proportions:

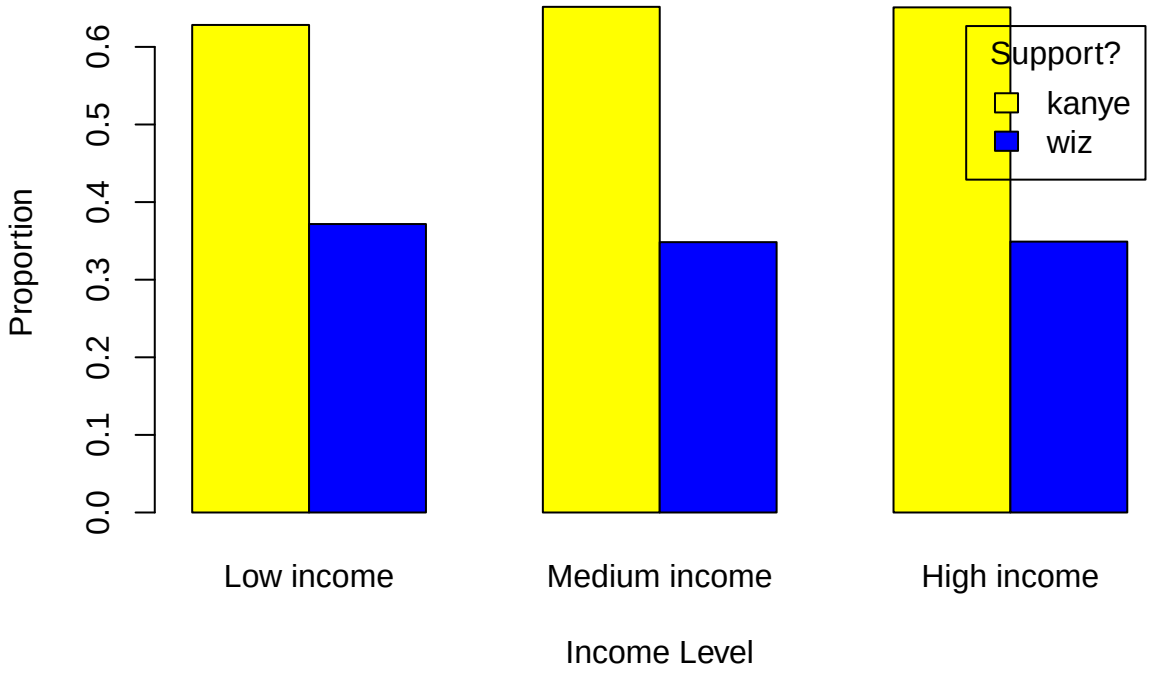
```r
support_prop <- prop.table(support, margin = 2) # column proportion
support_prop
```

```
##
##         Low income Medium income High income
##   kanye  0.6282828     0.6516291   0.6509434
##   wiz    0.3717172     0.3483709   0.3490566
```

Then give these to `barplot` as before . . .

## Plotting Proportions–Base R (2)

```
barplot(support_prop, beside = TRUE, col = c('yellow', 'blue'),
  xlab = 'Income Level', ylab = 'Proportion',
  legend = rownames(support), args.legend = list(title = 'Support?'))
```




## Plotting Percentages–Base R (1)

To plot percentages, simply convert the proportions to percents by multiplying them by 100:

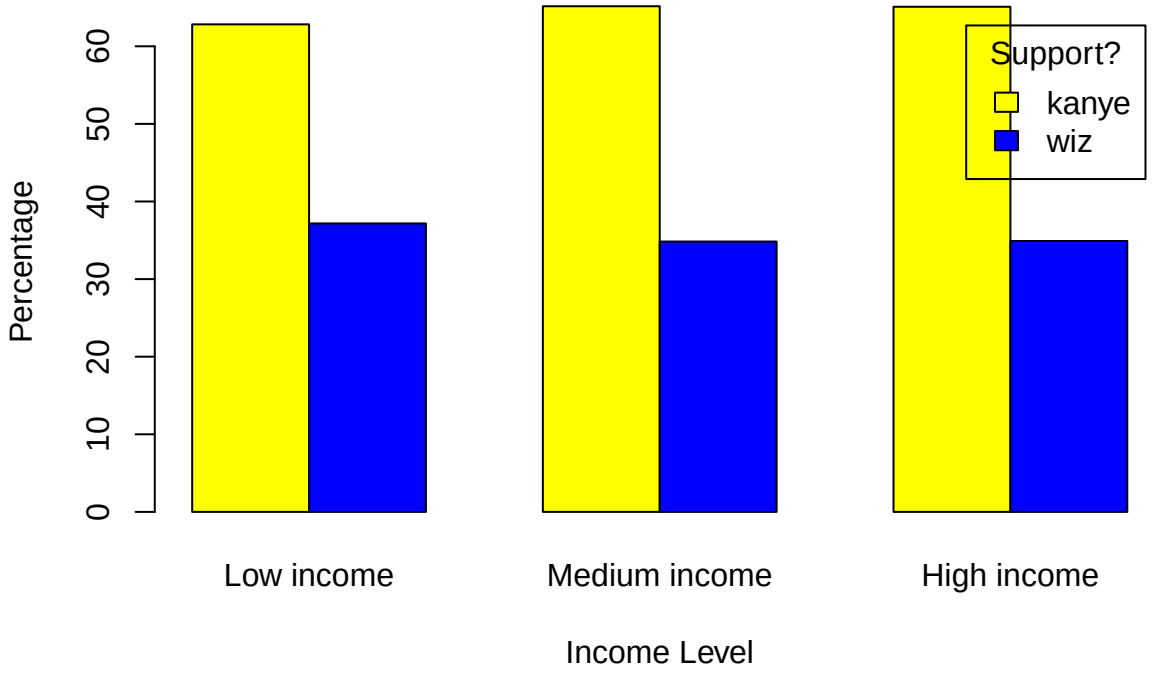
```
# Convert to percentages
support_perc <- support_prop * 100
support_perc
```

```
##
##         Low income Medium income High income
##   kanye   62.82828      65.16291    65.09434
##   wiz     37.17172      34.83709    34.90566
```

Then give these to `barplot` as before . . .

## Plotting Percentages–Base R (2)

```r
barplot(support_perc, beside = TRUE, col = c('yellow', 'blue'),
  xlab = 'Income Level', ylab = 'Percentage',
  legend = rownames(support), args.legend = list(title = 'Support?'))
```




## Joint distributions (categorical variables)

$\chi^2$ Test

```r
chisq.test(support)
```

```
##
##  Pearson's Chi-squared test
##
## data:  support
## X-squared = 0.58426, df = 2, p-value = 0.7467
```

Based on this test: is there a statistically significant association between income level and support for Kanye West and Wiz Khalifa?

## Seminar: Work with example survey data

1. Set up a Qualtrics Survey using *Worksheet: introduction to Qualtrics* on Moodle under *Qualtrics Resources*.
2. With a partner complete the survey design worksheet.

### Extras: reorder factors

You may want to **change the order** of a factor's variable's levels so that makes more substantive sense. For example:

```
library(MASS) # Contains example data set

# Relevel
survey$Smoke <- factor(survey$Smoke,
                       levels = c('Never', 'Occas', 'Regul', 'Heavy'))
survey$Exer <- factor(survey$Exer, levels = c('None', 'Some', 'Freq'))

# Create contingency table
smoking <- table(survey$Smoke, survey$Exer)
```