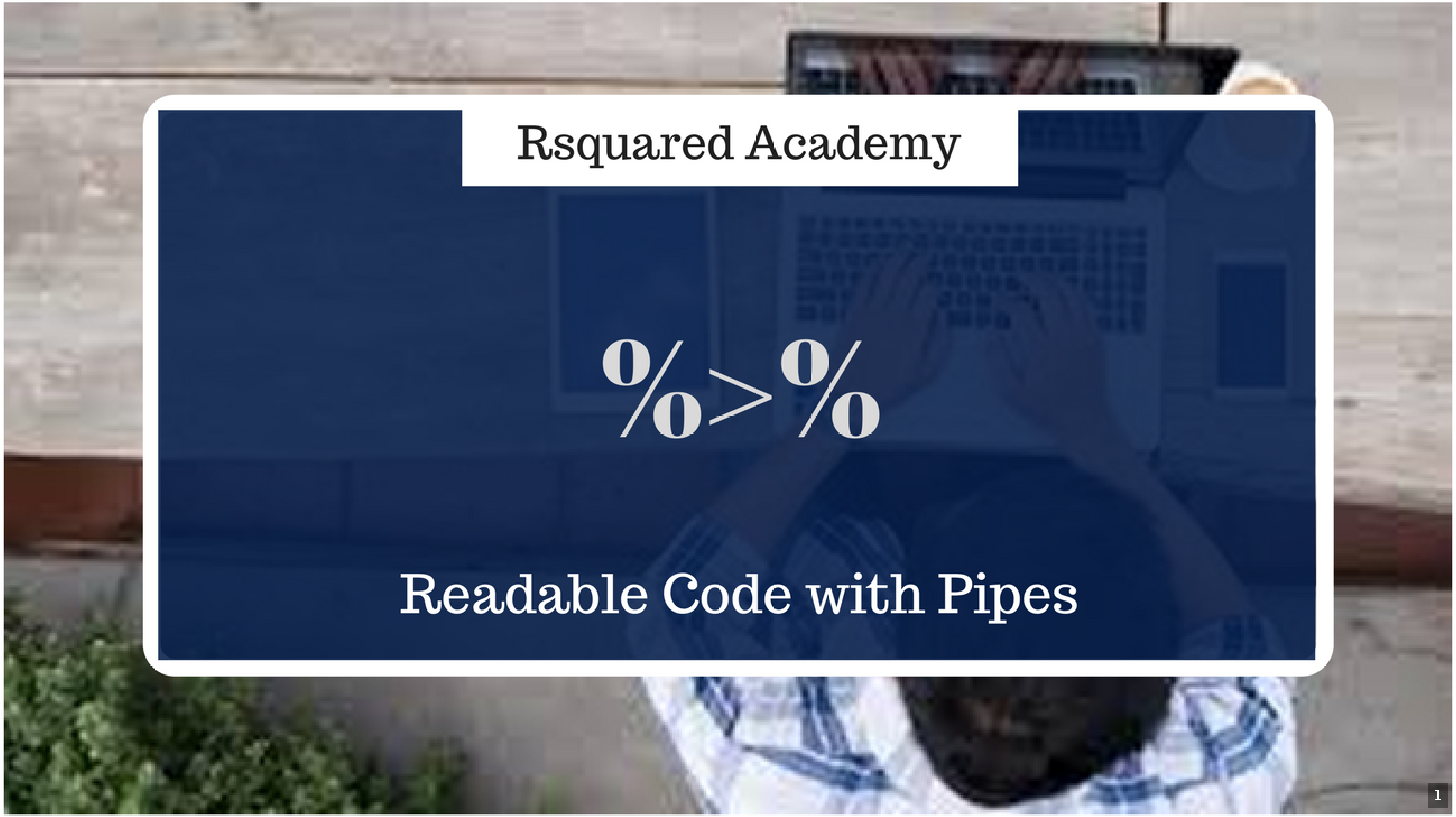


Rsquared Academy

%>%

Readable Code with Pipes

Agenda

- what are pipes?
- why use pipes?
- what are the different types of pipes?
- combining operations with pipes
- case studies

Introduction

R code contain a lot of parentheses in case of a sequence of multiple operations. When you are dealing with complex code, it results in nested function calls which are hard to read and maintain. The magrittr package by Stefan Milton Bache provides pipes enabling us to write R code that is readable.

Pipes allow us to clearly express a sequence of multiple operations by:

- structuring operations from left to right
- avoiding
  - nested function calls
  - intermediate steps
  - overwriting of original data
- minimizing creation of local variables

Pipes

If you are using tidyverse, magrittr will be automatically loaded. We will look at 3 different types of pipes:

- `%>%` : pipe a value forward into an expression or function call
- `%<>%`: result assigned to left hand side object instead of returning it
- `%$%` : expose names within left hand side objects to right hand side expressions

Libraries

```
library(magrittr)
library(readr)
library(purrr)
library(dplyr)
library(stringr)
```

Data

```
## # A tibble: 1,000 x 4
##    referrer n_pages duration purchase
##    <fct>      <dbl>    <dbl> <lgl>
##  1 google         1      693 FALSE
##  2 yahoo          1      459 FALSE
##  3 direct         1      996 FALSE
##  4 bing          18      468 TRUE
##  5 yahoo          1      955 FALSE
##  6 yahoo          5      135 FALSE
##  7 yahoo          1       75 FALSE
##  8 direct         1      908 FALSE
##  9 bing          19      209 FALSE
## 10 google         1      208 FALSE
## # ... with 990 more rows
```

Data Dictionary

- referrer: referrer website/search engine
- n_pages: number of pages visited
- duration: time spent on the website (in seconds)
- purchase: whether visitor purchased

Sample Data

```r
ecom_mini <- sample_n(ecom, size = 10)
```

head

```r
head(ecom, 10)
```

```
## # A tibble: 10 x 4
##    referrer n_pages duration purchase
##    <fct>      <dbl>    <dbl> <lgl>
##  1 google         1      693 FALSE
##  2 yahoo          1      459 FALSE
##  3 direct         1      996 FALSE
##  4 bing          18      468 TRUE
##  5 yahoo          1      955 FALSE
##  6 yahoo          5      135 FALSE
##  7 yahoo          1       75 FALSE
##  8 direct         1      908 FALSE
##  9 bing          19      209 FALSE
## 10 google         1      208 FALSE
```

Using pipe

```r
ecom %>% head(10)
```

```
## # A tibble: 10 x 4
##    referrer n_pages duration purchase
##    <fct>      <dbl>    <dbl> <lgl>
##  1 google         1      693 FALSE
##  2 yahoo          1      459 FALSE
##  3 direct         1      996 FALSE
##  4 bing          18      468 TRUE
##  5 yahoo          1      955 FALSE
##  6 yahoo          5      135 FALSE
##  7 yahoo          1       75 FALSE
##  8 direct         1      908 FALSE
##  9 bing          19      209 FALSE
## 10 google         1      208 FALSE
```

Square Root

```r
y <- ecom_mini$n_pages
y <- sqrt(y)

# combine above steps
sqrt(ecom_mini$n_pages)
```

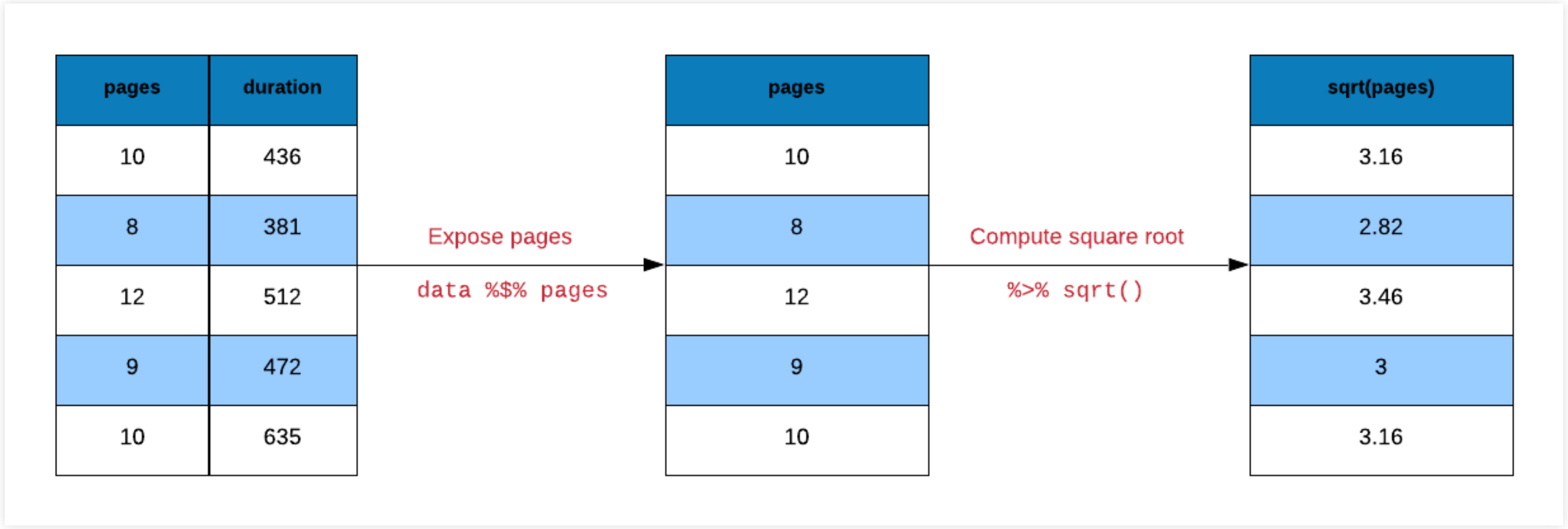
```
##  [1] 1.000000 1.000000 2.000000 1.000000 4.472136 1.000000 1.414214
##  [8] 1.000000 1.414214 1.000000
```

Square Root - Using pipe

```r
# select n_pages variable and assign it to y
ecom_mini %$%
  n_pages -> y

# compute square root of y and assign it to y
y %<>% sqrt()
```

Square Root - Using Pipe



pages	duration
10	436
8	381
12	512
9	472
10	635

pages
10
8
12
9
10

sqrt(pages)
3.16
2.82
3.46
3
3.16

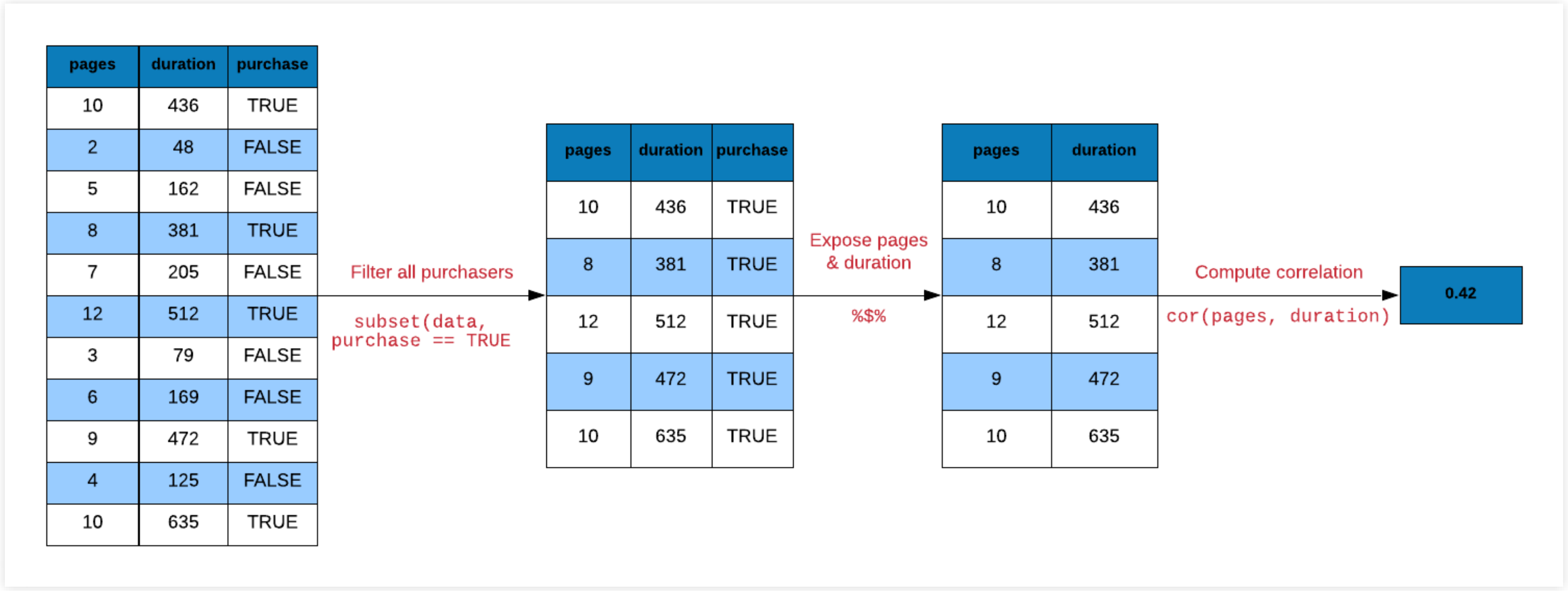
Square Root - Using pipe

```r
ecom_mini %$%
  n_pages %>%
  sqrt() -> y

y
```

```
##  [1] 1.000000 1.000000 2.000000 1.000000 4.472136 1.000000 1.414214
##  [8] 1.000000 1.414214 1.000000
```

Correlation



pages	duration	purchase
10	436	TRUE
2	48	FALSE
5	162	FALSE
8	381	TRUE
7	205	FALSE
12	512	TRUE
3	79	FALSE
6	169	FALSE
9	472	TRUE
4	125	FALSE
10	635	TRUE

Filter all purchasers

```
subset(data,
purchase == TRUE
```

pages	duration	purchase
10	436	TRUE
8	381	TRUE
12	512	TRUE
9	472	TRUE
10	635	TRUE

Expose pages & duration

```
%$%
```

pages	duration
10	436
8	381
12	512
9	472
10	635

Compute correlation

```
cor(pages, duration)
```

Correlation

```r
# without pipe
ecom1 <- subset(ecom, purchase)
cor(ecom1$n_pages, ecom1$duration)
```

```
## [1] 0.4290905
```

Correlation - Using pipe

```r
# with pipe
ecom %>%
  subset(purchase) %$%
  cor(n_pages, duration)
```

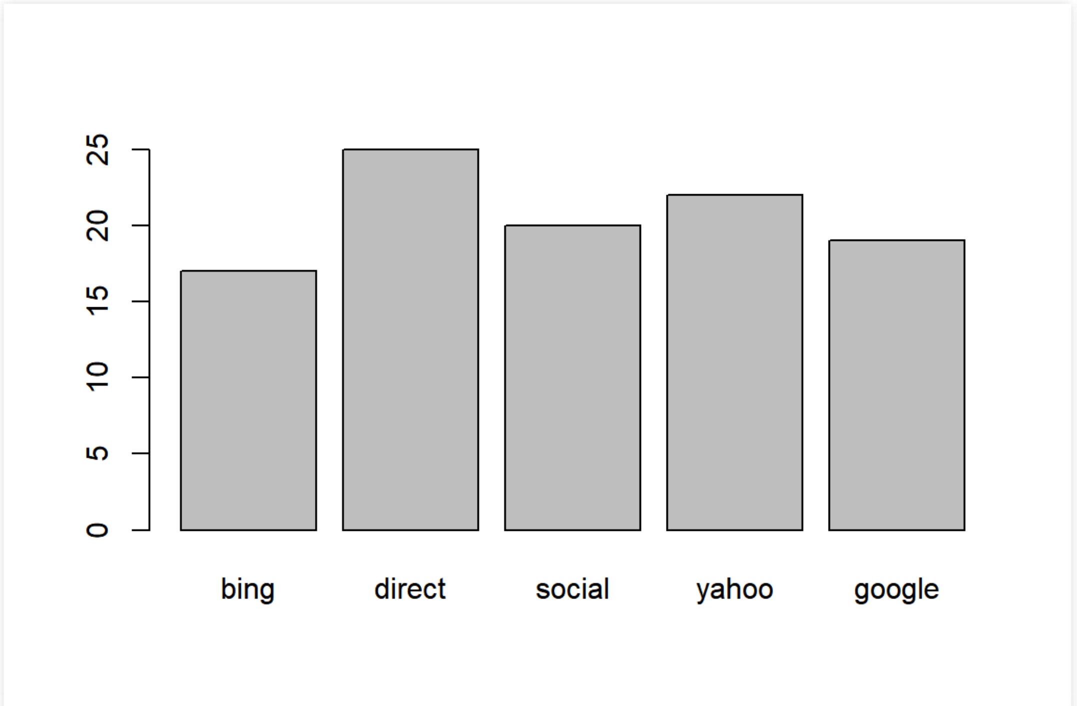
```
## [1] 0.4290905
```

```r
# using filter from dplyr and pipe
ecom %>%
  filter(purchase) %$%
  cor(n_pages, duration)
```

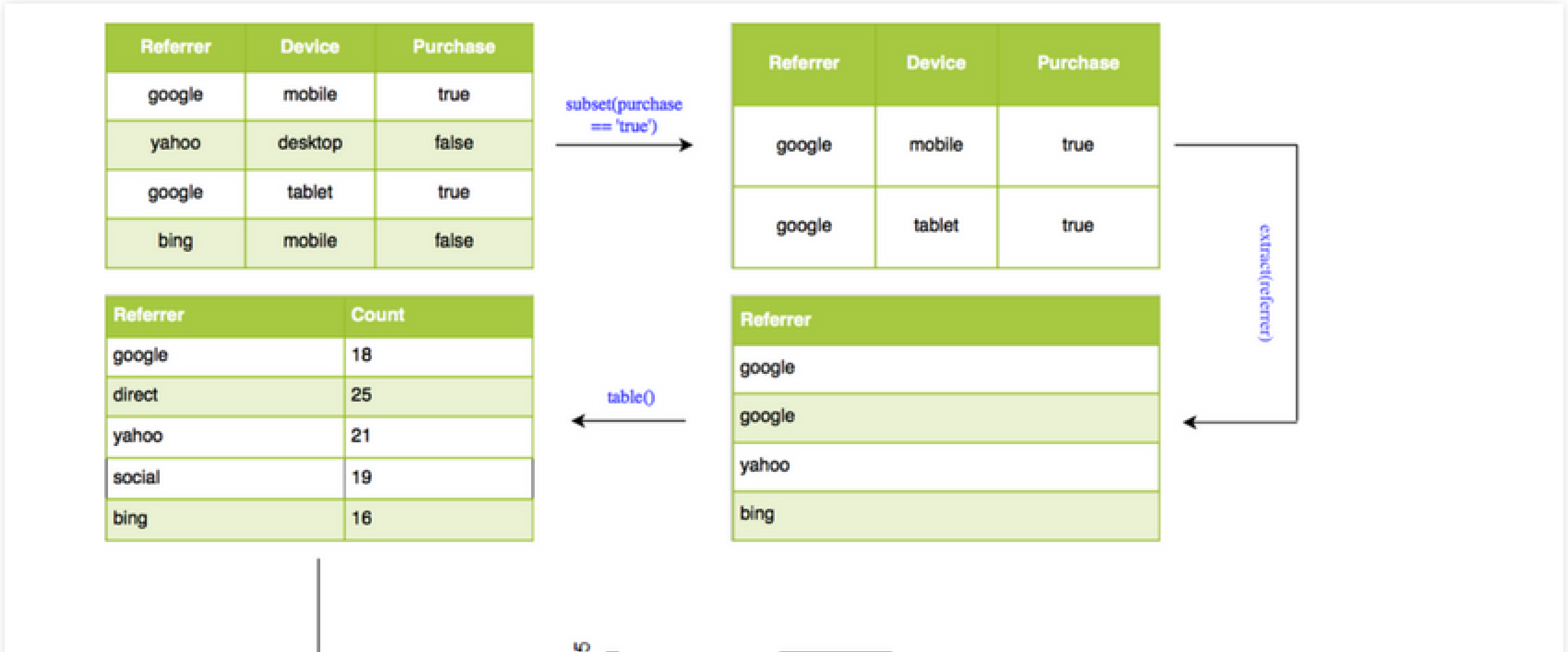
```
## [1] 0.4290905
```

Visualization

```r
barplot(table(subset(ecom, purchase)$referrer))
```



Visualization



Referrer	Device	Purchase
google	mobile	true
yahoo	desktop	false
google	tablet	true
bing	mobile	false

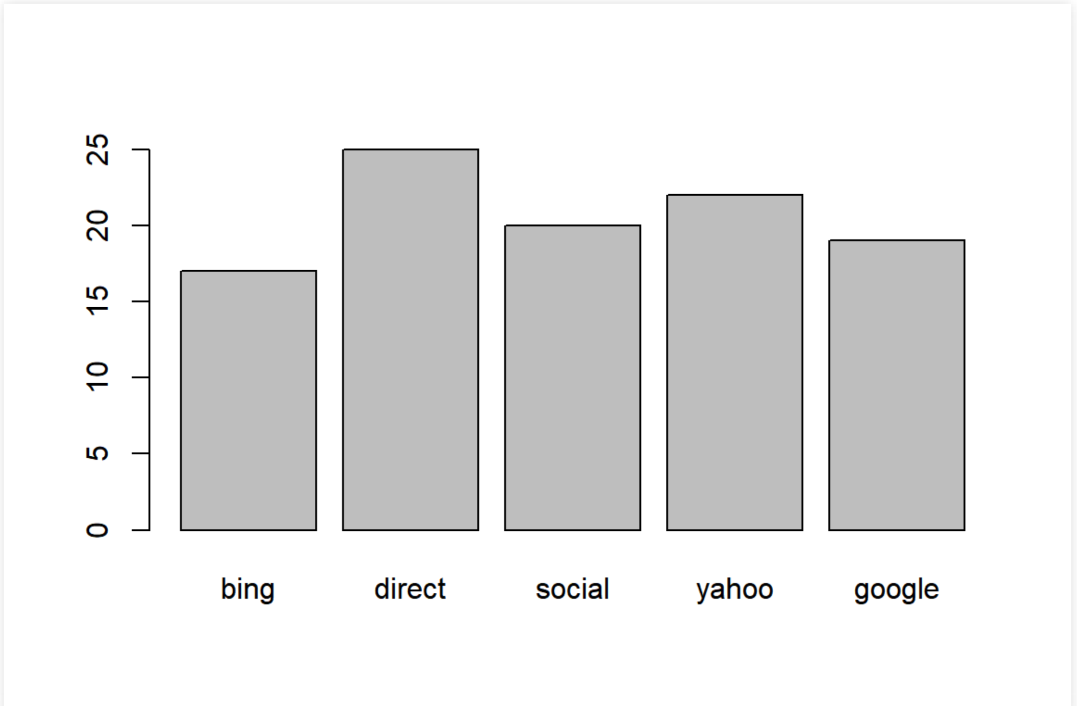
Referrer	Device	Purchase
google	mobile	true
google	tablet	true

Referrer
google
google
yahoo
bing

Referrer	Count
google	18
direct	25
yahoo	21
social	19
bing	16

Visualization - Using pipe

```
ecom %>%
  subset(purchase) %>%
  extract('referrer') %>%
  table() %>%
  barplot()
```



Regression

```r
summary(lm(duration ~ n_pages, data = ecom))
```

```
##
## Call:
## lm(formula = duration ~ n_pages, data = ecom)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -386.45 -213.03  -38.93  179.31  602.55
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  404.803     11.323  35.750  < 2e-16 ***
## n_pages       -8.355      1.296  -6.449 1.76e-10 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 263.3 on 998 degrees of freedom
## Multiple R-squared:   0.04,  Adjusted R-squared:  0.03904
## F-statistic: 41.58 on 1 and 998 DF,  p-value: 1.756e-10
```

Regression - Using pipe

```r
ecom %$%
  lm(duration ~ n_pages) %>%
  summary()
```

```
##
## Call:
## lm(formula = duration ~ n_pages)
##

## Residuals:
##     Min      1Q  Median      3Q     Max
## -386.45 -213.03  -38.93  179.31  602.55
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  404.803     11.323  35.750  < 2e-16 ***
## n_pages       -8.355      1.296  -6.449 1.76e-10 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 263.3 on 998 degrees of freedom
## Multiple R-squared:   0.04,  Adjusted R-squared:  0.03904
```

String Manipulation

```r
email <- 'jovialcann@anymail.com'

# without pipe
str_to_upper(str_sub(str_split(email, '@')[[1]][1], start = 1, end = 6))
```

```
## [1] "JOVIAL"
```

String Manipulation - Using Pipe

```r
# with pipe
email %>%
  str_split(pattern = '@') %>%
  extract2(1) %>%
  extract(1) %>%
  str_sub(start = 1, end = 6) %>%
  str_to_upper()
```

```
## [1] "JOVIAL"
```

Data Extraction

- `extract()`
- `extract2()`
- `use_series()`

Extract Column By Name

```
ecom_mini['n_pages']
```

```
## # A tibble: 10 x 1
##    n_pages
##      <dbl>
##  1       1
##  2       1
##  3       4
##  4       1
##  5      20
##  6       1
##  7       2
##  8       1
##  9       2
## 10       1
```

```
extract(ecom_mini, 'n_pages')
```

```
## # A tibble: 10 x 1
##    n_pages
##      <dbl>
##  1       1
```

Extract Column By Position

```
ecom_mini[2]
```

```
## # A tibble: 10 x 1
##    n_pages
##      <dbl>
##  1       1
##  2       1
##  3       4
##  4       1
##  5      20
##  6       1
##  7       2
##  8       1
##  9       2
## 10       1
```

Extract Column By Position

```r
extract(ecom_mini, 2)
```

```
## # A tibble: 10 x 1
##    n_pages
##      <dbl>
##  1       1
##  2       1
##  3       4
##  4       1
##  5      20
##  6       1
##  7       2
##  8       1
##  9       2
## 10       1
```

Extract Column (as vector)

```
ecom_mini$n_pages
```

```
##  [1]  1  1  4  1 20  1  2  1  2  1
```

Extract Column (as vector)

```
use_series(ecom_mini, 'n_pages')
```

```
##  [1]  1  1  4  1 20  1  2  1  2  1
```

Sample List

```r
ecom_list <- as.list(ecom_mini)
```

Extract List Element By Name

```r
# base
ecom_list[['n_pages']]
```

```
##  [1]  1  1  4  1 20  1  2  1  2  1
```

```r
ecom_list$n_pages
```

```
##  [1]  1  1  4  1 20  1  2  1  2  1
```

Extract List Element By Name

```r
# magrittr
extract2(ecom_list, 'n_pages')
```

```
##  [1]  1  1  4  1 20  1  2  1  2  1
```

```r
use_series(ecom_list, n_pages)
```

```
##  [1]  1  1  4  1 20  1  2  1  2  1
```

Extract List Element By Position

```
# base
ecom_list[[1]]
```

```
##  [1] bing   direct google direct google yahoo  google bing   yahoo  c
## Levels: bing direct social yahoo google
```

```
# magrittr
extract2(ecom_list, 1)
```

```
##  [1] bing   direct google direct google yahoo  google bing   yahoo  c
## Levels: bing direct social yahoo google
```

Extract List Element (as vector)

```r
# base
ecom_list$n_pages
```

```
##  [1]  1  1  4  1 20  1  2  1  2  1
```

```r
# magrittr
use_series(ecom_list, n_pages)
```

```
##  [1]  1  1  4  1 20  1  2  1  2  1
```

Arithmetic Operations

- `add()`
- `subtract()`
- `multiply_by()`
- `multiply_by_matrix()`
- `divide_by()`
- `divide_by_int()`
- `mod()`
- `raise_to_power()`

Addition

```
1:10 + 1
```

```
##  [1]  2  3  4  5  6  7  8  9 10 11
```

```
add(1:10, 1)
```

```
##  [1]  2  3  4  5  6  7  8  9 10 11
```

```
`+`(1:10, 1)
```

```
##  [1]  2  3  4  5  6  7  8  9 10 11
```

Multiplication

```
1:10 * 3
```

```
##  [1]  3  6  9 12 15 18 21 24 27 30
```

```
multiply_by(1:10, 3)
```

```
##  [1]  3  6  9 12 15 18 21 24 27 30
```

```
`*`(1:10, 3)
```

```
##  [1]  3  6  9 12 15 18 21 24 27 30
```

Division

```
1:10 / 2
```

```
##  [1] 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0
```

```
divide_by(1:10, 2)
```

```
##  [1] 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0
```

```
`/`(1:10, 2)
```

```
##  [1] 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0
```

Power

```
1:10 ^ 2
```

```
##   [1]   1   2   3   4   5   6   7   8   9  10  11  12  13  14  15  16
##  [18]  18  19  20  21  22  23  24  25  26  27  28  29  30  31  32  33
##  [35]  35  36  37  38  39  40  41  42  43  44  45  46  47  48  49  50
##  [52]  52  53  54  55  56  57  58  59  60  61  62  63  64  65  66  67
##  [69]  69  70  71  72  73  74  75  76  77  78  79  80  81  82  83  84
##  [86]  86  87  88  89  90  91  92  93  94  95  96  97  98  99 100
```

```
raise_to_power(1:10, 2)
```

```
##  [1]   1   4   9  16  25  36  49  64  81 100
```

```
`^`(1:10, 2)
```

```
##  [1]   1   4   9  16  25  36  49  64  81 100
```

Logical Operators

- `and()`
- `or()`
- `equals()`
- `not()`
- `is_greater_than()`
- `is_weakly_greater_than()`
- `is_less_than()`
- `is_weakly_less_than()`

Greater Than

```r
1:10 > 5
```

```
##  [1] FALSE FALSE FALSE FALSE FALSE  TRUE  TRUE  TRUE  TRUE  TRUE
```

```r
is_greater_than(1:10, 5)
```

```
##  [1] FALSE FALSE FALSE FALSE FALSE  TRUE  TRUE  TRUE  TRUE  TRUE
```

```r
`>`(1:10, 5)
```

```
##  [1] FALSE FALSE FALSE FALSE FALSE  TRUE  TRUE  TRUE  TRUE  TRUE
```

Weakly Greater Than

```
1:10 >= 5
```

```
##  [1] FALSE FALSE FALSE FALSE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
```

```
is_weakly_greater_than(1:10, 5)
```

```
##  [1] FALSE FALSE FALSE FALSE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
```

```
`>=`(1:10, 5)
```

```
##  [1] FALSE FALSE FALSE FALSE  TRUE  TRUE  TRUE  TRUE  TRUE  TRUE
```

Thank You

For more information please visit our website
www.rsquaredacademy.com