R Stats Bootcamp

1.4 - Data objects

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2024-11-28

R stats bootcamp - Module 1

Schedule:

- ~~Session 1: An introduction and script workflow~~
- ~~Session 2: R language~~
- ~~Session 3: R functions~~
- **Session 4: Data objects**
- Session 5: Data frames
- Session 6: Data subsetting

Session 4 objectives:

- Basic data types in R
- Data with factors
- `class()` an converting variables
- Vectors and Matrices
- Practice exercises

Data Objects in R

R space

Imagine you are floating in space in the R Global Environment and any data object you can see, you can call on by name to manipulate with functions. Let's call it R Space.

Data Objects in R

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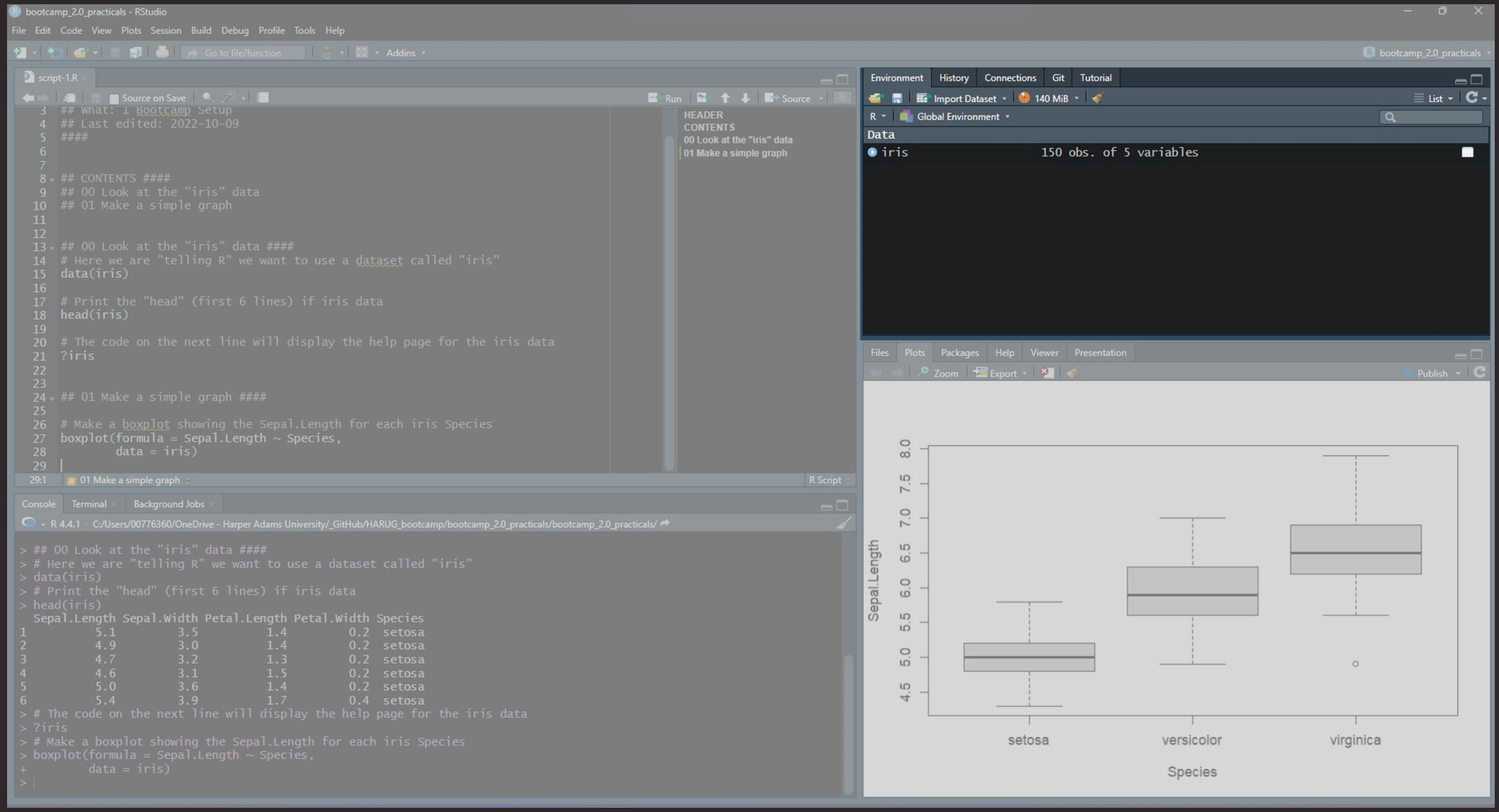
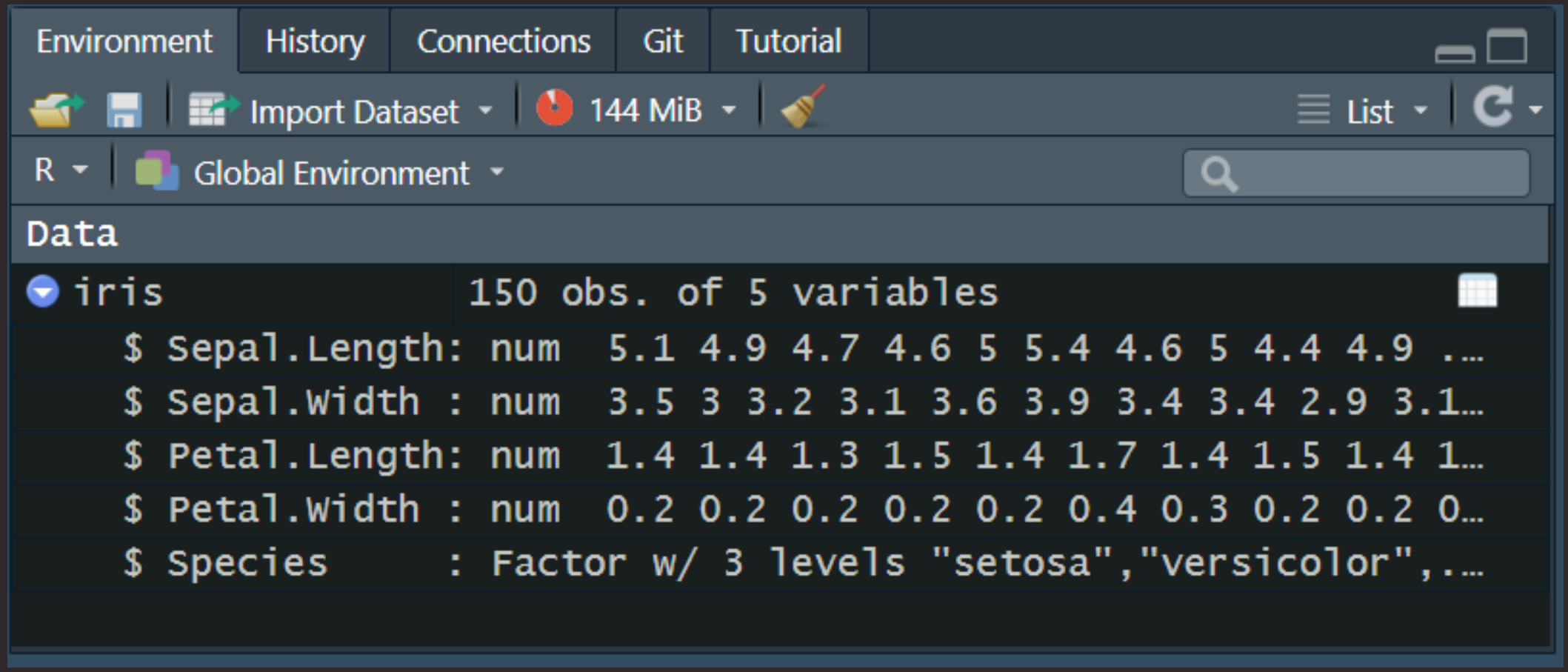
Imagine you are floating in space in the R Global Environment and any data object you can see, you can call on by name to manipulate with functions. Let's call it R Space.

- Fundamental way to analyse data in R is to be able to manipulate it with code
- Need to be able to store data somewhere

The Global Environment



The Global Environment



Basic data types

- Concept of “data objects”
- Data you can use in the global environment
- Data Type
  - refers to the kind of data *(Important for computers)*
  - determined automatically by R *(Passive aggressive butler)*
- Can tweak data types
  - May need or want to

Basic data types

```r
# numeric vector
variable_1 <-
  c(4, 5, 7, 6, 5, 4, 5, 6, 7, 10, 3, 4, 5, 6)

# logical vector
variable_2 <-
  c(TRUE, TRUE, TRUE, FALSE)

# character vector
variable_3 <-
  c("Peter Parker", " Bruce Wayne", "Groo the Wanderer")
```

Data Types Demo

Naming conventions for variables (1)

- Can contain letters, numbers and symbolic characters
- **MUST** begin with a letter
- **MUST** not contain spaces
  - Technically can, but difficult
- Forbidden characters: @, %, #, math operators etc.
- Case sensitive

Naming conventions for variables (2)

- Should be human readable
- Should be consistent
- Should be short and concise
  - Can use a “Data Dictionary” to help remember variables if needed

Naming Conventions in R Demo

HARUG R Stats Bootcamp by Ed Harris

Data with `factor()`

- What if you want to analyse categorical data?

Data with `factor()`

- What if you want to analyse categorical data?
- Sometimes referred to as a factor

Data with `factor()`

Two types of factors:

- Non-ordered factors
  - i.e., names of cows, variety of apples etc.
- Ordered factors
  - i.e., dose levels (Control, Half, Full)

`class()` and converting variables

```r
# non-ordered factor
variety <- c("short", "short", "short",
             "early", "early", "early",
             "hybrid", "hybrid", "hybrid")
```

`class()` and converting variables

```r
# non-ordered factor
variety <- c("short", "short", "short",
             "early", "early", "early",
             "hybrid", "hybrid", "hybrid")
```

```r
# Ordered factor
day <- c("Monday", "Monday",
         "Tuesday", "Tuesday",
         "Wednesday", "Wednesday",
         "Thursday")
```

Factor demo

HARUG R Stats Bootcamp by Ed Harris

Vectors and Matrices

Ways of organizing data

- **Vector**: One dimension from 1 to i, `my_vec[i]`
- **Matrix**: Two dimensions, rows and columns, `my_mat[i, j]`
- **Array**: Three (or more) dimensions, `my_array[i, j, k]`

Bracket notation

Each value in a vector has an address (commonly referred to as an indices)

`my_vec[i]` - accessing values from the “address” of where value lives

Vectors have an address?!

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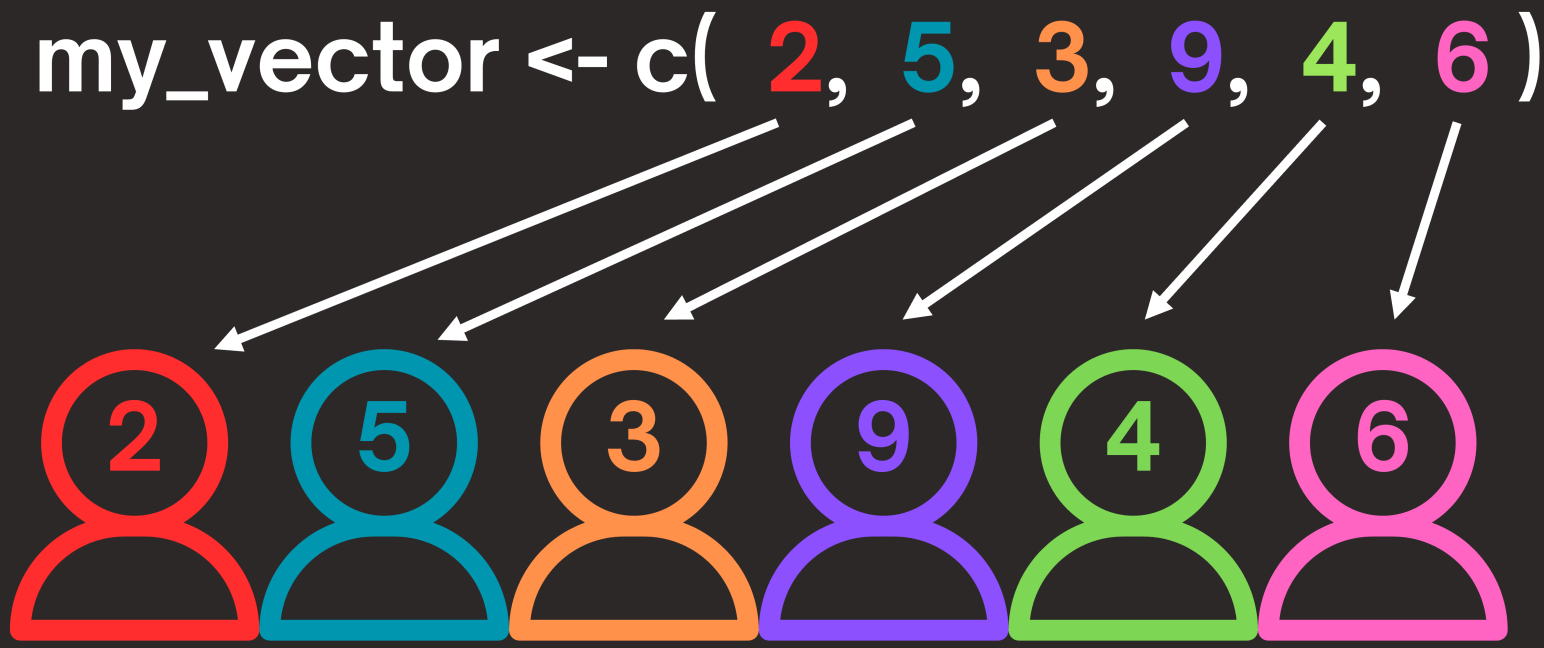
```
my_vector <- c( 2, 5, 3, 9, 4, 6 )
```

Vectors have an address?!

```
my_vector <- c( 2, 5, 3, 9, 4, 6 )
```

Vectors have an address?!



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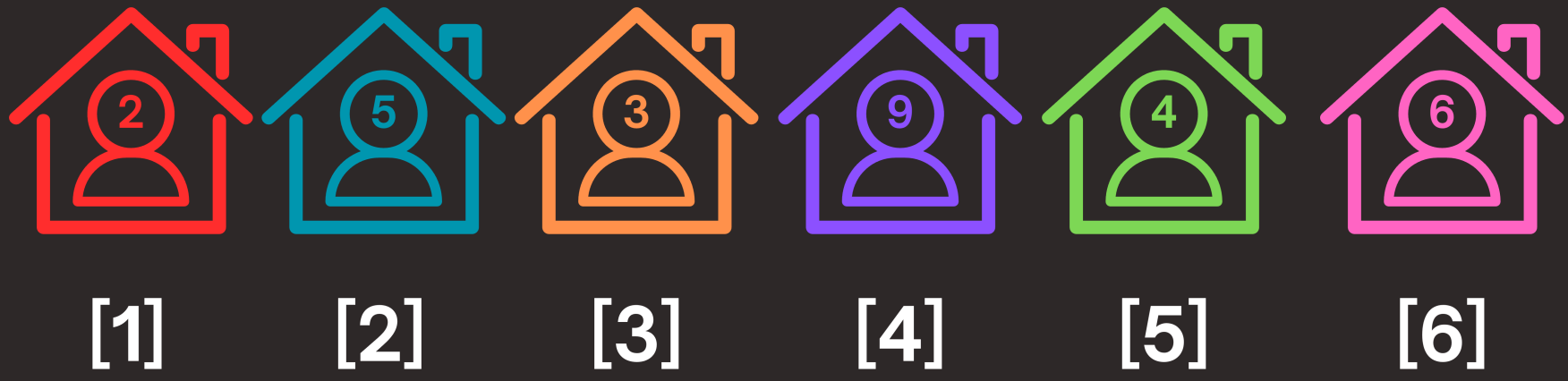

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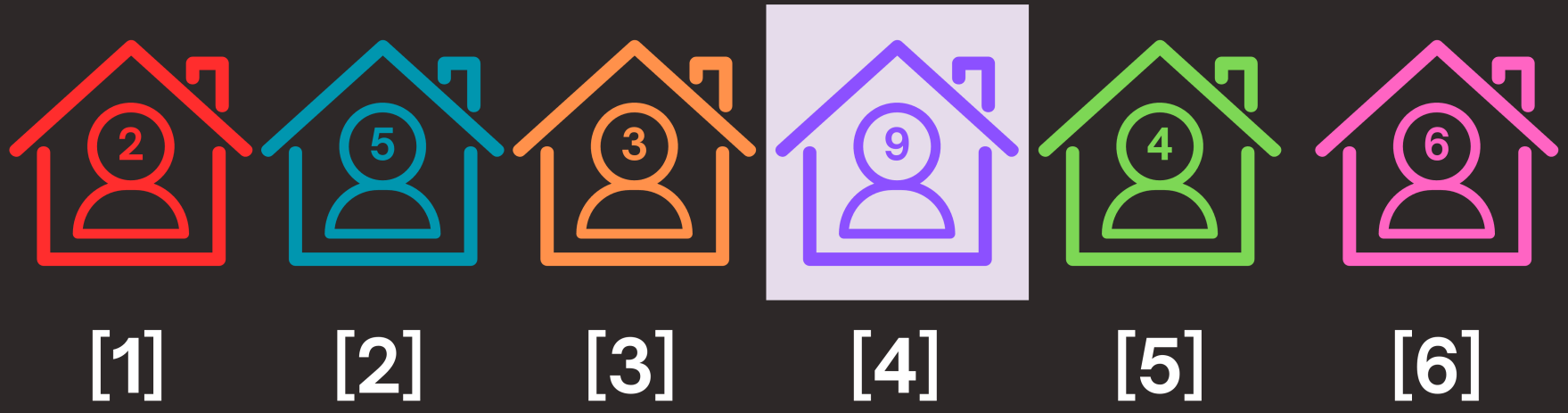


Vectors have an address?!

Vectors have an address?!

```
my_vector_2 <- c( 4, 1, 5, 6, 3, 8 )
```

Vectors have an address?!

```
my_vector_2 <- c( 4, 1, 5, 6, 3, 8 )
```

[1] [2] [3] [4] [5] [6]

Vectors have an address?!

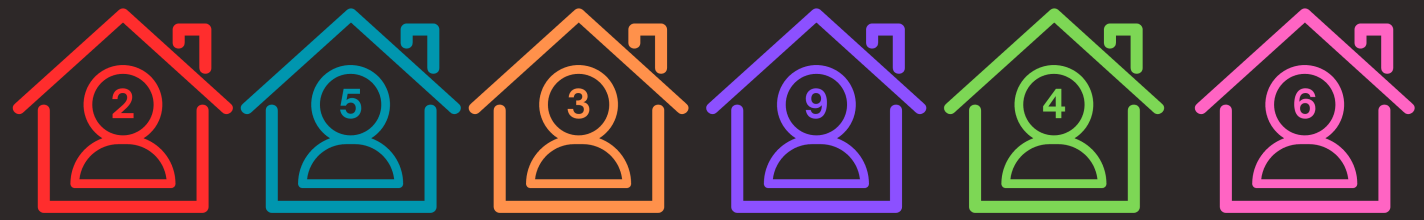
```
my_vector <- c( 2, 5, 3, 9, 4, 6 )
my_vector_2 <- c( 4, 1, 5, 6, 3, 8 )
```

```
my_matrix <- matrix( c (vector1, vector2),
                     nrow = 2,
                     byrow = TRUE)
```

Vectors have an address?!

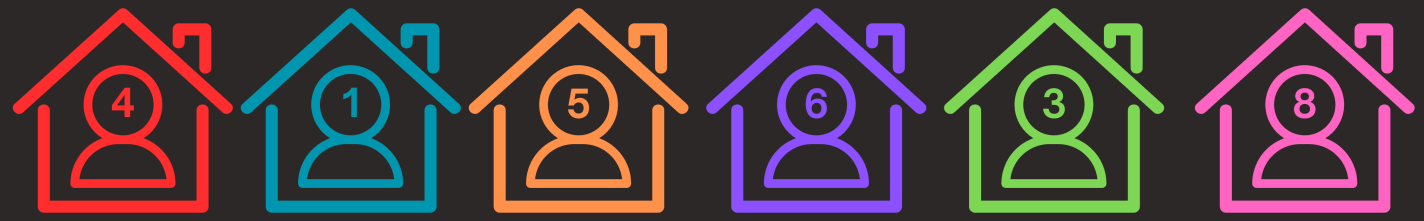
Matrix

Street [1,]



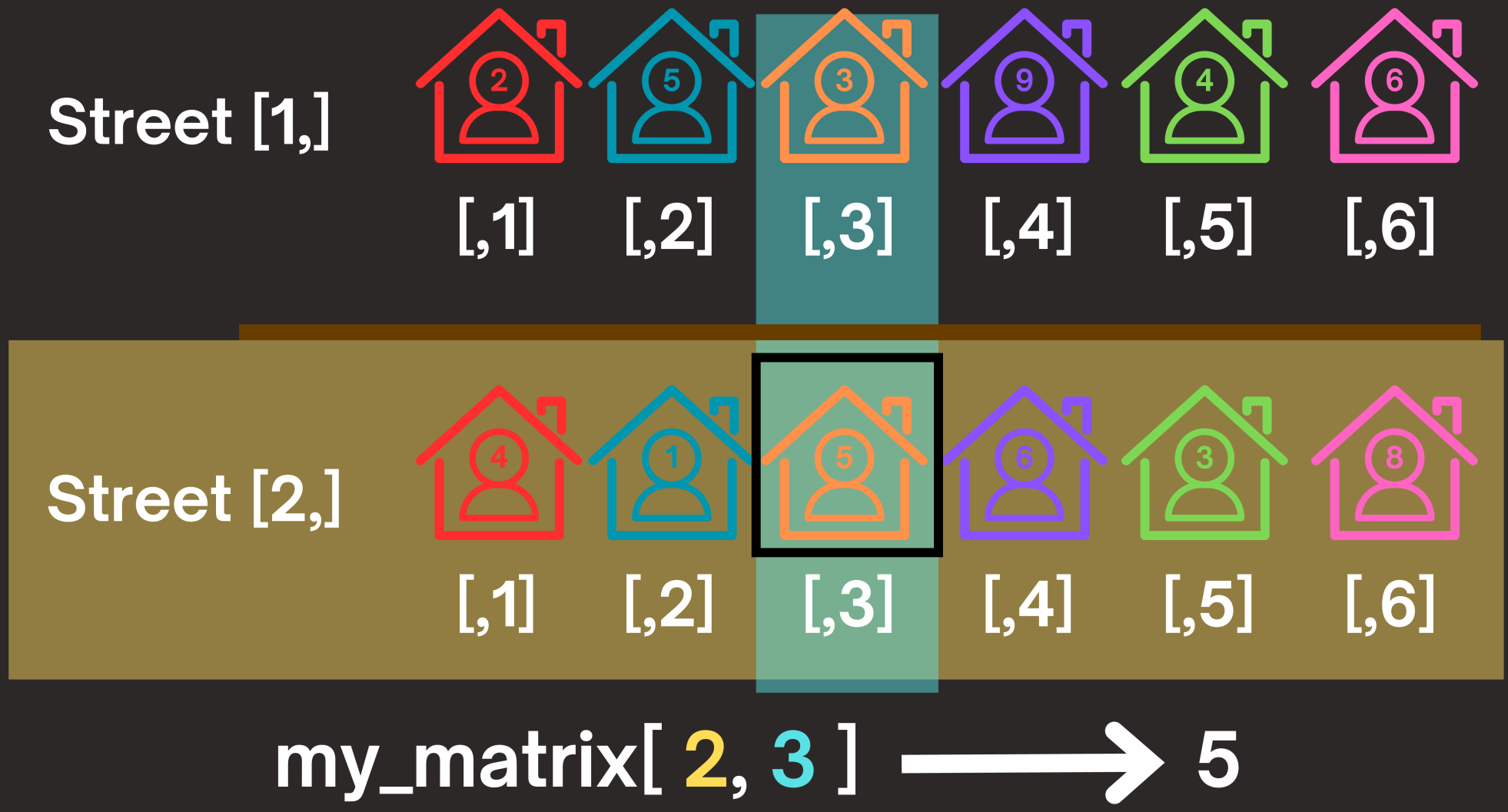
[,1] [,2] [,3] [,4] [,5] [,6]

Street [2,]



[,1] [,2] [,3] [,4] [,5] [,6]

Vectors have an address?!



Vectors

- Vectors can contain any data type
- Only one data type at a time

```r
# Yes
vec1 <- c(1,2,3,4,5,6)
vec2 <- c("Hello", ", ", "World", "!")

# No
vec3 <- c(1,2,3, "Hello", "World")
```

Matrices

- May look similar to data set
- Only one type of data (i.e., numeric or categorical)
- Columns and rows assigned numbers by default

```
1 mat1 <- matrix(data = vec1,
2                ncol = 4,
3                byrow = FALSE)
4
5 mat1
```

Vector and matrix demo

Matrix challenge

- **Challenge 1**: Set the row names for Mat1 using the rownames() function

Matrix challenge

- **Challenge 1**: Set the row names for Mat1 using the rownames() function
- **Challenge 2**: Make a matrix with 3 rows with the following vector,

```
vec2 <- c(2, 3, 5, 4, 5, 6, 7, 8, 9, 5, 3, 1),
```

- so that the first COLUMN contains numbers 2, 5, and 9, in the order for rows 1, 2, and 3 respectively ## Practice exercises

Practice exercises

Practice exercises 01

- Create a vector named my_var1 that contains the following 6 integers: `3, 6, 12, 7, 5, 1`
- Create a second vector called my_var2 that contains the following 2 integers: `2, 3`
- Evaluate the expression `my_var1 + my_var 2`
- Explain the output in terms of R mechanics in your own words.

Practice exercises 02

- Create a character vector with the names of the 12 months of the year.
- Convert the vector to a factor, with the month names in chronological order.
- Show your code.

Practice exercises 03

- What is wrong with the following code? Describe, show the code, and justify a fix for the problem in your own words.

```
mymat <- matrix(data = c( 12,   23,   45,
"34", "22", "31"))
```

Practice exercises 04

- Use the `array()` function to make a 2 x 2 x 3 array to produce the following output:

```
, , 1

     [, 1] [, 2]
[1, ]    1    3
[2, ]    2    4

, , 2

     [, 1] [, 2]
[1, ]    5    7
[2, ]    6    8

, , 3

     [, 1] [, 2]
[1, ]    9   11
[2, ]   10   12
```

Practice exercises 05

- Show the code to make the following matrix:

	cat	dog
male	22	88
female	71	29

Practice exercises 06

- Write a plausible practice question involving the use of the `matrix()` and `vector()` functions.