

Environments

```
load("./r_modifying_values.RData")
ls()
```

```
## [1] "a"          "ace"         "ace3"        "b"
## [5] "c"          "deal"        "deck"        "deck2"
## [9] "deck3"      "deck4"       "deck5"       "facecard"
## [13] "h"          "1"           "N"           "q"
## [17] "queen_spades" "queenOfSpades" "s"           "shuffle"
## [21] "vec"        "w"
```

```
head(deck)
```

```
##   face suit value
## 1 king spades   13
## 2 queen spades  12
## 3 jack spades   11
## 4 ten spades    10
## 5 nine spades   9
## 6 eight spades  8
```

```
deal
```

```
## function (cards)
## {
##   cards[1, ]
## }
```

```
deal(deck)
```

```
##   face suit value
## 1 king spades   13
```

```
deal(deck)
```

```
##   face suit value
## 1 king spades   13
```

```
deal(deck)
```

```
##   face suit value
## 1 king spades   13
```

```
head(shuffle(deck))
```

```
##   face suit value
## 42 jack hearts   11
## 45 eight hearts  8
## 14 king clubs   13
## 12 two spades   2
## 52 ace hearts   14
## 44 nine hearts  9
```

```
head(deck)
```

```
##   face suit value
## 1 king spades   13
## 2 queen spades  12
## 3 jack spades   11
## 4 ten spades    10
## 5 nine spades   9
## 6 eight spades  8
```

Environments

```
# install.packages("pryr", repos = "https://cran.rstudio.com")
library(pryr)
parenvs()
```

```
## label name
## 1 <environment: R_GlobalEnv> ""
```

```
parenvs(all = TRUE)
```

```
## label name
## 1 <environment: R_GlobalEnv> ""
## 2 <environment: package:pryr> "package:pryr"
## 3 <environment: package:stats> "package:stats"
## 4 <environment: package:graphics> "package:graphics"
## 5 <environment: package:grDevices> "package:grDevices"
## 6 <environment: package:utils> "package:utils"
## 7 <environment: package:datasets> "package:datasets"
## 8 <environment: package:methods> "package:methods"
## 9 <environment: 0x7fa6ad9735f0> "Autoloads"
## 10 <environment: base> ""
## 11 <environment: R_EmptyEnv> ""
```

```
search()
```

```
## [1] ".GlobalEnv" "package:pryr" "package:stats"
## [4] "package:graphics" "package:grDevices" "package:utils"
## [7] "package:datasets" "package:methods" "Autoloads"
## [10] "package:base"
```

Working with Environments

```
as.environment("package:stats")
```

```
## <environment: package:stats>
## attr(,"name")
## [1] "package:stats"
## attr(,"path")
## [1] "/Library/Frameworks/R.framework/Versions/3.4/Resources/library/stats"
```

```
globalenv()
```

```
## <environment: R_GlobalEnv>
```

```
baseenv()
```

```
## <environment: base>
```

```
emptyenv()
```

```
## <environment: R_EmptyEnv>
```

```
parent.env(globalenv())
```

```
## <environment: package:pryr>
## attr(,"name")
## [1] "package:pryr"
## attr(,"path")
## [1] "/Library/Frameworks/R.framework/Versions/3.4/Resources/library/pryr"
```

```
# parent.env(emptyenv())
ls(emptyenv())
```

```
## character(0)
```

```
ls(globalenv())
```

```
## [1] "a"      "ace"      "ace3"      "b"
## [5] "c"      "deal"      "deck"      "deck2"
## [9] "deck3"  "deck4"      "deck5"      "facecard"
## [13] "h"      "l"         "N"         "q"
## [17] "queen_spades" "queenOfSpades" "s"
## [21] "vec"      "w"
```

```
head(globalenv())$deck, 3)
```

```
## face suit value
## 1 king spades 13
## 2 queen spades 12
## 3 jack spades 11
```

```
assign("new", "Hello Global", envir = globalenv())
ls()
```

```
## [1] "a"      "ace"      "ace3"      "b"
## [5] "c"      "deal"      "deck"      "deck2"
## [9] "deck3"  "deck4"      "deck5"      "facecard"
## [13] "h"      "l"         "N"         "new"
## [17] "q"      "queen_spades" "queenOfSpades" "s"
## [21] "shuffle" "vec"      "w"
```

```
globalenv()$new
```

```
## [1] "Hello Global"
```

The Active Environment

Read pp. 97

```
environment()
```

```
## <environment: R_GlobalEnv>
```

Scoping Rules

Read pp.98

Assignment

```
new
```

```
## [1] "Hello Global"
```

```
new <- "Hello Active"
new
```

```
## [1] "Hello Active"
```

```
roll <- function(){
  die <- 1:6
  dice <- sample(die, size = 2, replace = TRUE)
  sum(dice)
}
```

Evaluation

```
show_env <- function(){  
  list(ran.in = environment(),  
       parent = parent.env(environment()),  
       objects = ls.str(environment()))  
}  
show_env()
```

```
## $ran.in  
## <environment: 0x7fa6ae6ccfb8>  
##  
## $parent  
## <environment: R_GlobalEnv>  
##  
## $objects
```

```
show_env()
```

```
## $ran.in  
## <environment: 0x7fa6ae743828>  
##  
## $parent  
## <environment: R_GlobalEnv>  
##  
## $objects
```

```
#> origin environment (pp. 101)  
environment(show_env)
```

```
## <environment: R_GlobalEnv>
```

```
environment(parents)
```

```
## <environment: namespace:pryr>
```

```
show_env <- function(){  
  a <- 1  
  b <- 2  
  c <- 3  
  list(ran.in = environment(),  
       parent = parent.env(environment()),  
       objects = ls.str(environment()))  
}  
show_env()
```

```
## $ran.in  
## <environment: 0x7fa6b0a2a778>  
##  
## $parent  
## <environment: R_GlobalEnv>  
##  
## $objects  
## a : num 1  
## b : num 2  
## c : num 3
```

```
#> R will copy over each argument to the runtime environment  
foo <- "take me to your runtime"  
show_env <- function(x = foo) {  
  list(ran.in = environment(),  
       parent = parent.env(environment()),  
       objects = ls.str(environment()))  
}  
show_env()
```

```
## $ran.in  
## <environment: 0x7fa6b0c04e08>  
##  
## $parent  
## <environment: R_GlobalEnv>  
##  
## $objects  
## x : chr "take me to your runtime"
```

```
#> Calling environment : R calls the function from  
rm("foo")  
# fix(show_env)  
show_env <- function() {  
  list(ran.in = environment(),  
       parent = parent.env(environment()),  
       objects = ls.str(environment()))  
}  
show_env()
```

```
## $ran.in  
## <environment: 0x7fa6b0d5cca0>  
##  
## $parent  
## <environment: R_GlobalEnv>  
##  
## $objects
```

Fix deal() and shuffle()

```
deal <- function(){
  deck[1, ]
}
deal()
```

```
##   face   suit value
## 1 king spades    13
```

```
environment(deal)
```

```
## <environment: R_GlobalEnv>
```

```
deal()
```

```
##   face   suit value
## 1 king spades    13
```

```
DECK <- deck
deck <- deck[-1, ]
nrow(deck)
```

```
## [1] 51
```

```
head(deck, n = 3)
```

```
##   face   suit value
## 2 queen spades    12
## 3 jack spades    11
## 4 ten spades     10
```

```
deck <- DECK
deal <- function(){
  card <- deck[1, ]
  deck <- deck[-1, ]
  card
}
deal()
```

```
##   face   suit value
## 1 king spades    13
```

```
#> `deal` will just create a slightly altered copy of `deck` in the runtime environment
head(deck, n = 6)
```

```
##   face   suit value
## 1 king spades    13
## 2 queen spades    12
## 3 jack spades    11
## 4 ten spades     10
## 5 nine spades     9
## 6 eight spades    8
```

```
deal <- function(){
  card <- deck[1, ]
  assign("deck", deck[-1, ], envir = globalenv())
  card
}
deal()
```

```
##   face   suit value
## 1 king spades    13
```

```
head(deck, 6)
```

```
##   face   suit value
## 2 queen spades    12
## 3 jack spades    11
## 4 ten spades     10
## 5 nine spades     9
## 6 eight spades    8
## 7 seven spades    7
```

```
deal()
```

```
##   face   suit value
## 2 queen spades    12
```

```
head(deck, 6)
```

```
##   face   suit value
## 3 jack spades    11
## 4 ten spades     10
## 5 nine spades     9
## 6 eight spades    8
## 7 seven spades    7
## 8 six spades      6
```

```
#> Fix `shuffle`()
shuffle <- function(cards) {
  random <- sample(1:52)
  cards[random, ]
}
deck <- DECK
head(deck, 3)
```

```
##      face      suit value
## 1 king spades      13
## 2 queen spades     12
## 3 jack spades      11
```

```
a <- shuffle(deck)
head(deck, 3)
```

```
##      face      suit value
## 1 king spades      13
## 2 queen spades     12
## 3 jack spades      11
```

```
head(a, 3)
```

```
##      face      suit value
## 38 two diamonds      2
## 20 seven clubs       7
## 29 jack diamonds     11
```

```
shuffle <- function(){
  random <- sample(1:52)
  assign("deck", DECK[random, ], envir = globalenv())
}
shuffle()
head(deck, 6)
```

```
##      face      suit value
## 20 seven clubs       7
## 24 three clubs       3
## 32 eight diamonds    8
## 19 eight clubs       8
## 29 jack diamonds     11
## 30 ten diamonds      10
```

Closures

```
shuffle()
deal()
```

```
##      face      suit value
## 10 four spades      4
```

```
deal()
```

```
##      face      suit value
## 8 six spades       6
```

```
setup <- function(deck) {
  DECK <- deck

  DEAL <- function(){
    card <- deck[1, ]
    assign("deck", deck[-1, ], envir = globalenv())
    card
  }

  SHUFFLE <- function(){
    random <- sample(1:52)
    assign("deck", DECK[random, ], envir = globalenv())
  }
  list(deal = DEAL, shuffle = SHUFFLE)
}
cards <- setup(deck)
ls()
```

```
## [1] "a"          "ace"        "ace3"       "b"
## [5] "c"          "cards"      "deal"       "deck"
## [9] "DECK"       "deck2"      "deck3"      "deck4"
## [13] "deck5"      "facecard"   "h"          "l"
## [17] "N"          "new"        "q"          "queen_spades"
## [21] "queenOfSpades" "roll"      "s"          "setup"
## [25] "show_env"   "shuffle"    "vec"        "w"
```

```
head(deck)
```

```
##      face      suit value
## 24 three clubs      3
## 42 jack hearts     11
## 46 seven hearts     7
## 35 five diamonds    5
## 3 jack spades      11
## 5 nine spades       9
```

```
str(cards)
```

```
## List of 2
## $ deal :function ( )
## .. attr(*, "srcref")=Class 'srcref' atomic [1:8] 7 11 11 3 11 3 7 11
## .. .. attr(*, "srcfile")=Classes 'srcfilecopy', 'srcfile' <environment: 0x7fa6b09e4548>
## $ shuffle:function ( )
## .. attr(*, "srcref")=Class 'srcref' atomic [1:8] 13 14 16 3 14 3 13 16
## .. .. attr(*, "srcfile")=Classes 'srcfilecopy', 'srcfile' <environment: 0x7fa6b09e4548>
```

```
deal <- cards$deal
shuffle <- cards$shuffle
deal
```

```
## function(){
##   card <- deck[1, ]
##   assign("deck", deck[-1, ], envir = globalenv())
##   card
## }
## <environment: 0x7fa6acf50630>
```

```
shuffle
```

```
## function(){
##   random <- sample(1:52)
##   assign("deck", DECK[random, ], envir = globalenv())
## }
## <environment: 0x7fa6acf50630>
```

```
environment(deal)
```

```
## <environment: 0x7fa6acf50630>
```

```
environment(shuffle)
```

```
## <environment: 0x7fa6acf50630>
```

```
setup <- function(deck) {
  DECK <- deck

  DEAL <- function() {
    card <- deck[1, ]
    assign("deck", deck[-1, ], envir = parent.env(environment()))
    card
  }

  SHUFFLE <- function() {
    random <- sample(1:52, size = 52)
    assign("deck", DECK[random, ], envir = parent.env(environment()))
  }

  list(deal = DEAL, shuffle = SHUFFLE)
}
cards <- setup(deck)
deal <- cards$deal
shuffle <- cards$shuffle
deal()
```

```
##   face suit value
## 24 three clubs   3
```

```
shuffle()
rm(deck)
shuffle()
deal()
```

```
##   face suit value
## 42 jack hearts   11
```

```
deal()
```

```
##   face suit value
## 5 nine spades    9
```

```
environment(deal)
```

```
## <environment: 0x7fa6b0b0d2d8>
```

```
environment(shuffle)
```

```
## <environment: 0x7fa6b0b0d2d8>
```