

Tidy evaluation with rlang :: CHEAT SHEET



Vocabulary

Tidy Evaluation (Tidy Eval) is not a package, but a framework for doing non-standard evaluation (i.e. delayed evaluation) that makes it easier to program with tidyverse functions.

pi **Symbol** - a name that represents a value or object stored in R. `is_symbol(expr(pi))`

Environment - a list-like object that binds symbols (names) to objects stored in memory. Each env contains a link to a second, **parent** env, which creates a chain, or search path, of environments. `is_environment(current_env())`

`rlang::caller_env(n = 1)` Returns calling env of the function it is in.

`rlang::child_env(parent, ...)` Creates new env as child of .parent. Also **env**.

`rlang::current_env()` Returns execution env of the function it is in.

1 **Constant** - a bare value (i.e. an atomic vector of length 1). `is_bare_atomic(1)`

abs (1) **Call object** - a vector of symbols/constants/calls that begins with a function name, possibly followed by arguments. `is_call(expr(abs(1)))`

pi **Code** - a sequence of symbols/constants/calls that will return a result if evaluated. Code can be:
 1. Evaluated immediately (**Standard Eval**)
 2. Quoted to use later (**Non-Standard Eval**)
`is_expression(expr(pi))`

e **Expression** - an object that stores quoted code without evaluating it. `is_expression(expr(a + b))`

q **Quosure** - an object that stores both quoted code (without evaluating it) and the code's environment. `is_quosure(quo(a + b))`

`rlang::quo_get_env(quo)` Return the environment of a quosure.

`rlang::quo_set_env(quo, expr)` Set the environment of a quosure.

`rlang::quo_get_expr(quo)` Return the expression of a quosure.

Expression Vector - a list of pieces of quoted code created by base R's `expression` and `parse` functions. Not to be confused with **expression**.

Quoting Code

Quote code in one of two ways (if in doubt use a quosure):

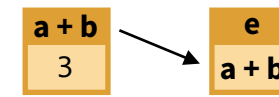
QUOSURES

Quosure - An expression that has been saved with an environment (aka a closure).
 A quosure can be evaluated later in the stored environment to return a predictable result.

`rlang::quo(expr)` Quote contents as a quosure. Also **quos** to quote multiple expressions. `a <- 1; b <- 2; q <- quo(a + b); qs <- quos(a, b)`

`rlang::enquo(arg)` Call from within a function to quote what the user passed to an argument as a quosure. Also **enquos** for multiple args.
`quote_this <- function(x) enquo(x)`
`quote_these <- function(...) enquos(...)`

`rlang::new_quosure(expr, env = caller_env())` Build a quosure from a quoted expression and an environment.
`new_quosure(expr(a + b), current_env())`



EXPRESSION

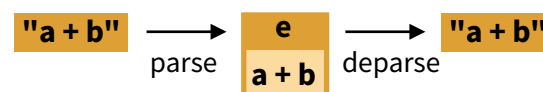
Quoted Expression - An expression that has been saved by itself.
 A quoted expression can be evaluated later to return a result that will depend on the environment it is evaluated in.

`rlang::expr(expr)` Quote contents. Also **exprs** to quote multiple expressions. `a <- 1; b <- 2; e <- expr(a + b); es <- exprs(a, b, a + b)`

`rlang::enexpr(arg)` Call from within a function to quote what the user passed to an argument. Also **enexprs** to quote multiple arguments.
`quote_that <- function(x) enexpr(x)`
`quote_those <- function(...) enexprs(...)`

`rlang::ensym(x)` Call from within a function to quote what the user passed to an argument as a symbol, accepts strings. Also **ensyms**.
`quote_name <- function(name) ensym(name)`
`quote_names <- function(...) ensyms(...)`

Parsing and Deparsing



Parse - Convert a string to a saved expression.

Deparse - Convert a saved expression to a string.

`rlang::parse_expr(x)` Convert a string to an expression. Also **parse_exprs**, **sym**, **parse_quo**, **parse_quos**. `e <- parse_expr("a + b")`

`rlang::expr_text(expr, width = 60L, nlines = Inf)` Convert expr to a string. Also **quo_name**. `expr_text(e)`

Building Calls

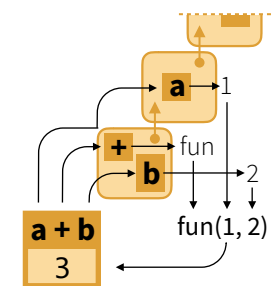
`rlang::call2(.fn, ..., .ns = NULL)` Create a call from a function and a list of args. Use **exec** to create and then evaluate the call. (See back page for !!!) `args <- list(x = 4, base = 2)`

`log(x = 4, base = 2)`

2

`call2("log", x = 4, base = 2)`
`call2("log", !!!args)`
`exec("log", x = 4, base = 2)`
`exec("log", !!!args)`

Evaluation



To evaluate an expression, R:

- Looks up the symbols in the expression in the active environment (or a supplied one), followed by the environment's parents
- Executes the calls in the expression

The result of an expression depends on which environment it is evaluated in.

QUOTED EXPRESSION

`rlang::eval_bare(expr, env = parent.frame())` Evaluate expr in env. `eval_bare(e, env = GlobalEnv)`

QUOSURES (and quoted exprs)

`rlang::eval_tidy(expr, data = NULL, env = caller_env())` Evaluate expr in env, using data as a **data mask**. Will evaluate quosures in their stored environment. `eval_tidy(q)`

Data Mask - If data is non-NULL, `eval_tidy` inserts data into the search path before env, matching symbols to names in data.

Use the pronoun **.data\$** to force a symbol to be matched in data, and **!!** (see back) to force a symbol to be matched in the environments.

`a <- 1; b <- 2`
`p <- quo(.data$a + !!b)`
`mask <- tibble(a = 5, b = 6)`
`eval_tidy(p, data = mask)`

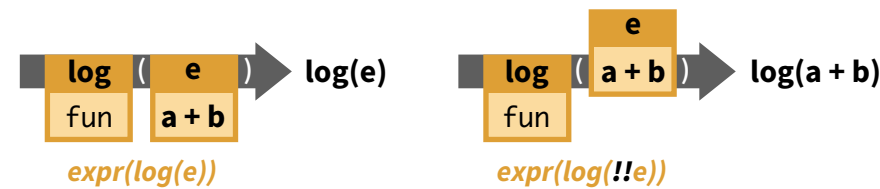
Quasiquotation (!! , !!! , :=)

QUOTATION

Storing an expression without evaluating it.
`e <- expr(a + b)`

QUASIQUOTATION

Quoting *some* parts of an expression while evaluating and then inserting the results of others (**unquoting** others).
`e <- expr(a + b)`

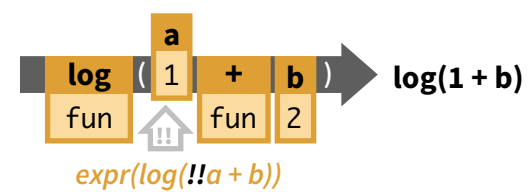


rlang provides **!!**, **!!!**, and **:=** for doing quasiquotation.

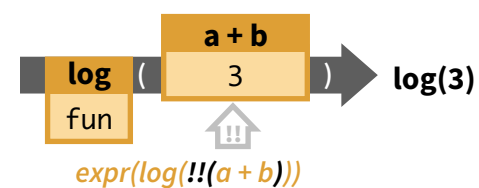
!!, **!!!**, and **:=** are not functions but syntax (symbols recognized by the functions they are passed to). Compare this to how

- . is used by `magrittr::%>%()`
- . is used by `stats::lm()`
- .x is used by `purrr::map()`, and so on.

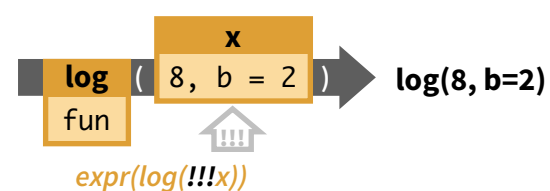
!!, **!!!**, and **:=** are only recognized by some rlang functions and functions that use those functions (such as tidyverse functions).



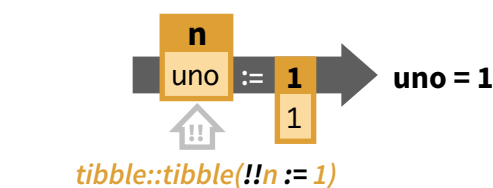
!! Unquotes the symbol or call that follows. Pronounced "unquote" or "bang-bang." `a <- 1; b <- 2`
`expr(log(!!a + b))`



Combine **!!** with **()** to unquote a longer expression.
`a <- 1; b <- 2`
`expr(log(!!(a + b)))`



!!! Unquotes a vector or list and splices the results as arguments into the surrounding call. Pronounced "unquote splice" or "bang-bang-bang."
`x <- list(8, b = 2)`
`expr(log(!!!x))`



:= Replaces an = to allow unquoting within the name that appears on the left hand side of the =. Use with **!!**
`n <- expr(uno)`
`tibble::tibble(!!n := 1)`

Programming Recipes

Quoting function- A function that quotes any of its arguments internally for delayed evaluation in a chosen environment. You must take **special steps to program safely** with a quoting function.

How to spot a quoting function?

A function quotes an argument if the argument returns an error when run on its own.

Many tidyverse functions are quoting functions: e.g. **filter**, **select**, **mutate**, **summarise**, etc.

```
dplyr::filter(cars, speed == 25)
  speed dist
1     25  85
```

```
speed == 25
Error!
```

PROGRAM WITH A QUOTING FUNCTION

```
data_mean <- function(data, var) {
  require(dplyr)
  var <- rlang::enquo(var)      1
  data %>%
    summarise(mean = mean(!!var)) 2
}
```

1. Capture user argument that will be quoted with `rlang::enquo`.
2. Unquote the user argument into the quoting function with **!!**.

PASS MULTIPLE ARGUMENTS TO A QUOTING FUNCTION

```
group_mean <- function(data, var, ...) {
  require(dplyr)
  var <- rlang::enquo(var)      1
  group_vars <- rlang::enquos(...) 1
  data %>%
    group_by(!!!group_vars) %>% 2
    summarise(mean = mean(!!var))
}
```

1. Capture user arguments that will be quoted with `rlang::enquos`.
2. Unquote splice the user arguments into the quoting function with **!!!**.

MODIFY USER ARGUMENTS

```
my_do <- function(f, v, df) {
  f <- rlang::enquo(f)          1
  v <- rlang::enquo(v)          1
  todo <- rlang::quo(!!f)(!!v) 2
  rlang::eval_tidy(todo, df)   3
}
```

1. Capture user arguments with `rlang::enquo`.
2. **Unquote** user arguments into a new expression or quosure to use
3. **Evaluate** the new expression/quosure instead of the original argument

APPLY AN ARGUMENT TO A DATA FRAME

```
subset2 <- function(df, rows) {
  rows <- rlang::enquo(rows)    1
  vals <- rlang::eval_tidy(rows, data = df) 2
  df[vals, , drop = FALSE]
}
```

1. Capture user argument with `rlang::enquo`.
2. Evaluate the argument with `rlang::eval_tidy`. Pass the data frame to `data` to use as a data mask.
3. **Suggest** in your documentation that your users use the `.data` and `.env` pronouns.

WRITE A FUNCTION THAT RECOGNIZES QUASIQUOTATION (!! , !!! , :=)



1. Capture the quasiquotation-aware argument with `rlang::enquo`.
2. Evaluate the arg with `rlang::eval_tidy`.

```
add1 <- function(x) {
  q <- rlang::enquo(x)      1
  rlang::eval_tidy(q) + 1   2
}
```

PASS TO ARGUMENT NAMES OF A QUOTING FUNCTION

```
named_mean <- function(data, var) {
  require(dplyr)
  var <- rlang::ensym(var)    1
  data %>%
    summarise(!!name := mean(!!var)) 2
}
```

1. Capture user argument that will be quoted with `rlang::ensym`.
2. Unquote the name into the quoting function with **!!** and **:=**.

PASS CRAN CHECK

```
#! @importFrom rlang .data 1
mutate_y <- function(df) {
  dplyr::mutate(df, y = .data$a + 1) 2
}
```

Quoted arguments in tidyverse functions can trigger an **R CMD check** NOTE about undefined global variables. To avoid this:

1. Import `rlang::.data` to your package, perhaps with the `roxygen2` tag `@importFrom rlang .data`
2. Use the `.data$` pronoun in front of variable names in tidyverse functions