Package 'lazyeval'

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Title Lazy (Non-Standard) Evaluation

Description An alternative approach to non-standard evaluation using formulas. Provides a full implementation of LISP style 'quasiquotation', making it easier to generate code with other code.

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R topics documented:

`as.lazy` *Convert an object to a lazy expression or lazy dots.*

Description

Convert an object to a lazy expression or lazy dots.

Usage

```
as.lazy(x, env = baseenv())

as.lazy_dots(x, env)
```

Arguments

`x`	An R object. Current methods for `as.lazy()` convert formulas, character vectors, calls and names. Methods for `as.lazy_dots()` convert lists and character vectors (by calling `lapply()` with `as.lazy()`.)
`env`	Environment to use for objects that don't already have associated environment.

Examples

```
as.lazy(~ x + 1)
as.lazy(quote(x + 1), globalenv())
as.lazy("x + 1", globalenv())

as.lazy_dots(list(~x, y = ~z + 1))
as.lazy_dots(c("a", "b", "c"), globalenv())
as.lazy_dots(~x)
as.lazy_dots(quote(x), globalenv())
as.lazy_dots(quote(f()), globalenv())
as.lazy_dots(lazy(x))
```

ast_ *Display a call (or expression) as a tree.*

Description

ast_ takes a quoted expression; ast does the quoting for you.

Usage

```
ast_(x, width = getOption("width"))

ast(x)
```

Arguments

x	Quoted call, list of calls, or expression to display.
width	Display width, defaults to current width as reported by getOption("width").

Examples

```
ast(f(x, 1, g(), h(i())))
ast(if (TRUE) 3 else 4)
ast(function(a = 1, b = 2) {a + b + 10})
ast(f(x)(y)(z))

ast_(quote(f(x, 1, g(), h(i()))))
ast_(quote(if (TRUE) 3 else 4))
ast_(expression(1, 2, 3))
```

as_name *Coerce an object to a name or call.*

Description

These are a S3 generics with built-in methods for names, calls, formuals, and strings. The distinction between a name and a call is particularly important when coercing from a string. Coercing to a call will parse the string, coercing to a name will create a (potentially) non-syntactic name.

Usage

```
as_name(x)

as_call(x)
```

Arguments

x	An object to coerce

Examples

```
as_name("x + y")
as_call("x + y")

as_call(~ f)
as_name(~ f())
```

`call_modify` *Modify the arguments of a call.*

Description

Modify the arguments of a call.

Usage

```
call_modify(call, new_args, env = parent.frame())

call_standardise(call, env = parent.frame())
```

Arguments

`call`	A call to modify. It is first standardised with `call_standardise`.
`new_args`	A named list of expressions (constants, names or calls) used to modify the call. Use `NULL` to remove arguments.
`env`	Environment in which to look up call value.

Examples

```
call <- quote(mean(x, na.rm = TRUE))
call_standardise(call)

# Modify an existing argument
call_modify(call, list(na.rm = FALSE))
call_modify(call, list(x = quote(y)))

# Remove an argument
call_modify(call, list(na.rm = NULL))

# Add a new argument
call_modify(call, list(trim = 0.1))

# Add an explicit missing argument
call_modify(call, list(na.rm = quote(expr = )))
```

call_new *Create a call by "hand"*

Description

Create a call by "hand"

Usage

```
call_new(f, ..., .args = list())
```

Arguments

f	Function to call. For make_call, either a string, a symbol or a quoted call. For do_call, a bare function name or call.
..., .args	Arguments to the call either in or out of a list

Examples

```
# f can either be a string, a symbol or a call
call_new("f", a = 1)
call_new(quote(f), a = 1)
call_new(quote(f()), a = 1)

#' Can supply arguments individually or in a list
call_new(quote(f), a = 1, b = 2)
call_new(quote(f), .args = list(a = 1, b = 2))
```

expr_label *Find the expression associated with an argument*

Description

expr_find() finds the full expression; expr_text() turns the expression into a single string; expr_label() formats it nicely for use in messages. expr_env() finds the environment associated with the expression.

Usage

```
expr_label(x)

expr_text(x, width = 60L, nlines = Inf)

expr_find(x)

expr_env(x, default_env)
```

Arguments

x	A promise (function argument)
width	Width of each line
nlines	Maximum number of lines to extract.
default_env	If supplied, expr_env will return this if the promise has already been forced. Otherwise it will throw an error.

Details

These functions never force promises, and will work even if a promise has previously been forced.

Examples

```
# Unlike substitute(), expr_find() finds the original expression
f <- function(x) g(x)
g <- function(y) h(y)
h <- function(z) list(substitute(z), expr_find(z))

f(1 + 2 + 3)

expr_label(10)
# Names a quoted with ``
expr_label(x)
# Strings are encoded
expr_label("a\nb")
# Expressions are captured
expr_label(a + b + c)
# Long expressions are collapsed
expr_label(foo({
  1 + 2
  print(x)
}))
```

---

function_new *Create a function by "hand"*

Description

This constructs a new function given it's three components: list of arguments, body code and parent environment.

Usage

```
function_new(args, body, env = parent.frame())
```

Arguments

args	A named list of default arguments. Note that if you want arguments that don't have defaults, you'll need to use the special function alist, e.g. alist(a = , b = 1)
body	A language object representing the code inside the function. Usually this will be most easily generated with quote
env	The parent environment of the function, defaults to the calling environment of make_function

Examples

```
f <- function(x) x + 3
g <- function_new(alist(x = ), quote(x + 3))

# The components of the functions are identical
identical(formals(f), formals(g))
identical(body(f), body(g))
identical(environment(f), environment(g))

# But the functions are not identical because f has src code reference
identical(f, g)

attr(f, "srcref") <- NULL
# Now they are:
stopifnot(identical(f, g))
```

---

f_capture *Make a promise explicit by converting into a formula.*

Description

This should be used sparingly if you want to implement true non-standard evaluation with 100% magic. I recommend avoiding this unless you have strong reasons otherwise since requiring arguments to be formulas only adds one extra character to the inputs, and otherwise makes life much much simpler.

Usage

```
f_capture(x)

dots_capture(..., .ignore_empty = TRUE)
```

Arguments

x, ...	An unevaluated promises
.ignore_empty	If TRUE, empty arguments will be silently dropped.

Value

`f_capture` returns a formula; `dots_capture` returns a list of formulas.

Examples

```
f_capture(a + b)
dots_capture(a + b, c + d, e + f)

# These functions will follow a chain of promises back to the
# original definition
f <- function(x) g(x)
g <- function(y) h(y)
h <- function(z) f_capture(z)
f(a + b + c)
```

---

f_eval_rhs *Evaluate a formula*

Description

`f_eval_rhs` evaluates the RHS of a formula and `f_eval_lhs` evaluates the LHS. `f_eval` is a shortcut for `f_eval_rhs` since that is what you most commonly need.

Usage

```
f_eval_rhs(f, data = NULL)

f_eval_lhs(f, data = NULL)

f_eval(f, data = NULL)

find_data(x)
```

Arguments

`f`	A formula. Any expressions wrapped in `uq()` will will be "unquoted", i.e. they will be evaluated, and the results inserted back into the formula. See `f_interp` for more details.
`data`	A list (or data frame). `find_data` is a generic used to find the data associated with a given object. If you want to make `f_eval` work for your own objects, you can define a method for this generic.
`x`	An object for which you want to find associated data.

Details

If `data` is specified, variables will be looked for first in this object, and if not found in the environment of the formula.

Pronouns

When used with `data`, `f_eval` provides two pronouns to make it possible to be explicit about where you want values to come from: `.env` and `.data`. These are thin wrappers around `.data` and `.env` that throw errors if you try to access non-existent values.

Examples

```
f_eval(~ 1 + 2 + 3)

# formulas automatically capture their enclosing environment
foo <- function(x) {
  y <- 10
  ~ x + y
}
f <- foo(1)
f
f_eval(f)

# If you supply data, f_eval will look their first:
f_eval(~ cyl, mtcars)

# To avoid ambiguity, you can use .env and .data pronouns to be
# explicit:
cyl <- 10
f_eval(~ .data$cyl, mtcars)
f_eval(~ .env$cyl, mtcars)

# Imagine you are computing the mean of a variable:
f_eval(~ mean(cyl), mtcars)
# How can you change the variable that's being computed?
# The easiest way is "unquote" with uq()
# See ?f_interp for more details
var <- ~ cyl
f_eval(~ mean( uq(var) ), mtcars)
```

`f_interp` *Interpolate a formula*

Description

Interpolation replaces sub-expressions of the form `uq(x)` with the evaluated value of `x`, and inlines sub-expressions of the form `uqs(x)`.

Usage

```
f_interp(f, data = NULL)

uq(x, data = NULL)
```

```
uqf(x)

uqs(x)
```

Arguments

f	A one-sided formula.
data	When called from inside f_eval, this is used to pass on the data so that nested formulas are evaluated in the correct environment.
x	For uq and uqf, a formula. For uqs, a a vector.

Theory

Formally, f_interp is a quasiquote function, uq() is the unquote operator, and uqs() is the unquote splice operator. These terms have a rich history in LISP, and live on in modern languages like http://docs.julialang.org/en/release-0.1/manual/metaprogramming/ and https://docs.racket-lang.org/reference/quasiquote.htm

Examples

```
f_interp(x ~ 1 + uq(1 + 2 + 3) + 10)

# Use uqs() if you want to add multiple arguments to a function
# It must evaluate to a list
args <- list(1:10, na.rm = TRUE)
f_interp(~ mean( uqs(args) ))

# You can combine the two
var <- quote(xyz)
extra_args <- list(trim = 0.9)
f_interp(~ mean( uq(var) , uqs(extra_args) ))

foo <- function(n) {
  ~ 1 + uq(n)
}
f <- foo(10)
f
f_interp(f)
```

---

f_list *Build a named list from the LHS of formulas*

Description

f_list makes a new list; as_f_list takes an existing list. Both take the LHS of any two-sided formulas and evaluate it, replacing the current name with the result.

Usage

```
f_list(...)

as_f_list(x)
```

Arguments

`...`	Named arguments.
`x`	An existing list

Value

A named list.

Examples

```
f_list("y" ~ x)
f_list(a = "y" ~ a, ~ b, c = ~c)
```

---

f_new *Create a formula object by "hand".*

Description

Create a formula object by "hand".

Usage

```
f_new(rhs, lhs = NULL, env = parent.frame())
```

Arguments

`lhs, rhs`	A call, name, or atomic vector.
`env`	An environment

Value

A formula object

Examples

```
f_new(quote(a))
f_new(quote(a), quote(b))
```

f_rhs *Get/set formula components.*

Description

f_rhs extracts the righthand side, f_lhs extracts the lefthand side, and f_env extracts the environment. All functions throw an error if f is not a formula.

Usage

```
f_rhs(f)

f_rhs(x) <- value

f_lhs(f)

f_lhs(x) <- value

f_env(f)

f_env(x) <- value
```

Arguments

f, x	A formula
value	The value to replace with.

Value

f_rhs and f_lhs return language objects (i.e. atomic vectors of length 1, a name, or a call). f_env returns an environment.

Examples

```
f_rhs(~ 1 + 2 + 3)
f_rhs(~ x)
f_rhs(~ "A")
f_rhs(1 ~ 2)

f_lhs(~ y)
f_lhs(x ~ y)

f_env(~ x)
```

f_text *Turn RHS of formula into a string/label.*

Description

Equivalent of `expr_text()` and `expr_label()` for formulas.

Usage

```
f_text(x, width = 60L, nlines = Inf)

f_label(x)
```

Arguments

x	A formula.
width	Width of each line
nlines	Maximum number of lines to extract.

Examples

```
f <- ~ a + b + bc
f_text(f)
f_label(f)

# Names a quoted with ``
f_label(~ x)
# Strings are encoded
f_label(~ "a\nb")
# Long expressions are collapsed
f_label(~ foo({
  1 + 2
  print(x)
}))
```

f_unwrap *Unwrap a formula*

Description

This interpolates values in the formula that are defined in its environment, replacing the environment with its parent.

Usage

```
f_unwrap(f)
```

Arguments

f	A formula to unwrap.

Examples

```
n <- 100
f <- ~ x + n
f_unwrap(f)
```

---

interp *Interpolate values into an expression.*

Description

This is useful if you want to build an expression up from a mixture of constants and variables.

Usage

```
interp(`_obj`, ..., .values)
```

Arguments

_obj	An object to modify: can be a call, name, formula, lazy, or a string.
..., .values	Either individual name-value pairs, or a list (or environment) of values.

Examples

```
# Interp works with formulas, lazy objects, quoted calls and strings
interp(~ x + y, x = 10)
interp(lazy(x + y), x = 10)
interp(quote(x + y), x = 10)
interp("x + y", x = 10)

# Use as.name if you have a character string that gives a
# variable name
interp(~ mean(var), var = as.name("mpg"))
# or supply the quoted name directly
interp(~ mean(var), var = quote(mpg))

# Or a function!
interp(~ f(a, b), f = as.name("+"))
# Remember every action in R is a function call:
# http://adv-r.had.co.nz/Functions.html#all-calls

# If you've built up a list of values through some other
# mechanism, use .values
interp(~ x + y, .values = list(x = 10))

# You can also interpolate variables defined in the current
```

```
# environment, but this is a little risky.
y <- 10
interp(~ x + y, .values = environment())
```

`is_formula` *Is object a formula?*

Description

Is object a formula?

Usage

```
is_formula(x)
```

Arguments

`x`	Object to test

Examples

```
is_formula(~ 10)
is_formula(10)
```

`is_lang` *Is an object a language object?*

Description

These helpers are consistent wrappers around their base R equivalents. A language object is either an atomic vector (typically a scalar), a name (aka a symbol), a call, or a pairlist (used for function arguments).

Usage

```
is_lang(x)

is_name(x)

is_call(x)

is_pairlist(x)

is_atomic(x)
```

Arguments

x	An object to test.

See Also

as_name() and as_call() for coercion functions.

Examples

```
q1 <- quote(1)
is_lang(q1)
is_atomic(q1)

q2 <- quote(x)
is_lang(q2)
is_name(q2)

q3 <- quote(x + 1)
is_lang(q3)
is_call(q3)
```

---

lazy_ *Capture expression for later lazy evaluation.*

Description

lazy() uses non-standard evaluation to turn promises into lazy objects; lazy_() does standard evaluation and is suitable for programming.

Usage

```
lazy_(expr, env)

lazy(expr, env = parent.frame(), .follow_symbols = TRUE)
```

Arguments

expr	Expression to capture. For lazy_ must be a name or a call.
env	Environment in which to evaluate expr.
.follow_symbols	If TRUE, the default, follows promises across function calls. See vignette("chained-promises") for details.

Details

Use lazy() like you'd use substitute() to capture an unevaluated promise. Compared to substitute() it also captures the environment associated with the promise, so that you can correctly replay it in the future.

Examples

```
lazy_(quote(a + x), globalenv())

# Lazy is designed to be used inside a function - you should
# give it the name of a function argument (a promise)
f <- function(x = b - a) {
  lazy(x)
}
f()
f(a + b / c)

# Lazy also works when called from the global environment. This makes
# easy to play with interactively.
lazy(a + b / c)

# By default, lazy will climb all the way back to the initial promise
# This is handy if you have if you have nested functions:
g <- function(y) f(y)
h <- function(z) g(z)
f(a + b)
g(a + b)
h(a + b)

# To avoid this behavour, set .follow_symbols = FALSE
# See vignette("chained-promises") for details
```

---

lazy_dots *Capture ... (dots) for later lazy evaluation.*

Description

Capture ... (dots) for later lazy evaluation.

Usage

```
lazy_dots(..., .follow_symbols = FALSE, .ignore_empty = FALSE)
```

Arguments

`...`	Dots from another function
`.follow_symbols`	If `TRUE`, the default, follows promises across function calls. See `vignette("chained-promises")` for details.
`.ignore_empty`	If `TRUE`, empty arguments will be ignored.

Value

A named list of `lazy` expressions.

Examples

```
lazy_dots(x = 1)
lazy_dots(a, b, c * 4)

f <- function(x = a + b, ...) {
  lazy_dots(x = x, y = a + b, ...)
}
f(z = a + b)
f(z = a + b, .follow_symbols = TRUE)

# .follow_symbols is off by default because it causes problems
# with lazy loaded objects
lazy_dots(letters)
lazy_dots(letters, .follow_symbols = TRUE)

# You can also modify a dots like a list. Anything on the RHS will
# be coerced to a lazy.
l <- lazy_dots(x = 1)
l$y <- quote(f)
l[c("y", "x")]
l["z"] <- list(~g)

c(lazy_dots(x = 1), lazy_dots(f))
```

---

lazy_eval *Evaluate a lazy expression.*

Description

Evaluate a lazy expression.

Usage

```
lazy_eval(x, data = NULL)
```

Arguments

x	A lazy object or a formula.
data	Option, a data frame or list in which to preferentially look for variables before using the environment associated with the lazy object.

Examples

```
f <- function(x) {
  z <- 100
  ~ x + z
}
z <- 10
lazy_eval(f(10))
```

```
lazy_eval(f(10), list(x = 100))
lazy_eval(f(10), list(x = 1, z = 1))

lazy_eval(lazy_dots(a = x, b = z), list(x = 10))
```

`make_call` *Make a call with* `lazy_dots` *as arguments.*

Description

In order to exactly replay the original call, the environment must be the same for all of the dots. This function circumvents that a little, falling back to the `baseenv()` if all environments aren't the same.

Usage

```
make_call(fun, args)
```

Arguments

`fun`	Function as symbol or quoted call.
`args`	Arguments to function; must be a `lazy_dots` object, or something `as.lazy_dots()` can coerce..

Value

A list:

`env`	The common environment for all elements
`expr`	The expression

Examples

```
make_call(quote(f), lazy_dots(x = 1, 2))
make_call(quote(f), list(x = 1, y = ~x))
make_call(quote(f), ~x)

# If no known or no common environment, fails back to baseenv()
make_call(quote(f), quote(x))
```

`missing_arg` *Generate a missing argument.*

Description

Generate a missing argument.

Usage

```
missing_arg()
```

Examples

```
f_interp(~f(x = uq(missing_arg())))
f_interp(~f(x = uq(NULL)))
```

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