

# Package ‘reticulate’

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**Type** Package

**Title** Interface to 'Python'

**Version** 1.38.0

**Description** Interface to 'Python' modules, classes, and functions. When calling into 'Python', R data types are automatically converted to their equivalent 'Python' types. When values are returned from 'Python' to R they are converted back to R types. Compatible with all versions of 'Python'  $\geq 2.7$ .

**License** Apache License 2.0

**URL** <https://rstudio.github.io/reticulate/>,  
<https://github.com/rstudio/reticulate>

**BugReports** <https://github.com/rstudio/reticulate/issues>

**SystemRequirements** Python ( $\geq 2.7.0$ )

**Encoding** UTF-8

**Depends** R ( $\geq 3.5$ )

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==.python.builtin.object

*S3 Ops Methods for Python Objects*

**Description**

Reticulate provides S3 Ops Group Generic Methods for Python objects. The methods invoke the equivalent python method of the object.

**Usage**

```
## S3 method for class 'python.builtin.object'
e1 == e2

## S3 method for class 'python.builtin.object'
e1 != e2

## S3 method for class 'python.builtin.object'
e1 < e2

## S3 method for class 'python.builtin.object'
e1 > e2

## S3 method for class 'python.builtin.object'
e1 >= e2
```

```
## S3 method for class 'python.builtin.object'  
e1 <= e2  
  
## S3 method for class 'python.builtin.object'  
e1 + e2  
  
## S3 method for class 'python.builtin.object'  
e1 - e2  
  
## S3 method for class 'python.builtin.object'  
e1 * e2  
  
## S3 method for class 'python.builtin.object'  
e1 / e2  
  
## S3 method for class 'python.builtin.object'  
e1 %% e2  
  
## S3 method for class 'python.builtin.object'  
e1 %*% e2  
  
## S3 method for class 'python.builtin.object'  
e1 ^ e2  
  
## S3 method for class 'python.builtin.object'  
e1 & e2  
  
## S3 method for class 'python.builtin.object'  
e1 | e2  
  
## S3 method for class 'python.builtin.object'  
!e1  
  
## S3 method for class 'python.builtin.object'  
x %*% y
```

### Arguments

e1, e2, x, y      A python object.

### Value

Result from evaluating the Python expression. If either of the arguments to the operator was a Python object with `convert=FALSE`, then the result will also be a Python object with `convert=FALSE` set. Otherwise, the result will be converted to an R object if possible.

### Operator Mappings

| R expression           | Python expression      | First python method invoked             |
|------------------------|------------------------|---|
| <code>x == y</code>    | <code>x == y</code>    | <code>type(x).__eq__(x, y)</code>       |
| <code>x != y</code>    | <code>x != y</code>    | <code>type(x).__ne__(x, y)</code>       |
| <code>x &lt; y</code>  | <code>x &lt; y</code>  | <code>type(x).__lt__(x, y)</code>       |
| <code>x &gt; y</code>  | <code>x &gt; y</code>  | <code>type(x).__gt__(x, y)</code>       |
| <code>x &gt;= y</code> | <code>x &gt;= y</code> | <code>type(x).__ge__(x, y)</code>       |
| <code>x &lt;= y</code> | <code>x &lt;= y</code> | <code>type(x).__le__(x, y)</code>       |
| <code>+ x</code>       | <code>+ x</code>       | <code>type(x).__pos__(x)</code>         |
| <code>- y</code>       | <code>- x</code>       | <code>type(x).__neg__(x)</code>         |
| <code>x + y</code>     | <code>x + y</code>     | <code>type(x).__add__(x, y)</code>      |
| <code>x - y</code>     | <code>x - y</code>     | <code>type(x).__sub__(x, y)</code>      |
| <code>x * y</code>     | <code>x * y</code>     | <code>type(x).__mul__(x, y)</code>      |
| <code>x / y</code>     | <code>x / y</code>     | <code>type(x).__truediv__(x, y)</code>  |
| <code>x %% y</code>    | <code>x // y</code>    | <code>type(x).__floordiv__(x, y)</code> |
| <code>x % y</code>     | <code>x % y</code>     | <code>type(x).__mod__(x, y)</code>      |
| <code>x ^ y</code>     | <code>x ** y</code>    | <code>type(x).__pow__(x, y)</code>      |
| <code>x &amp; y</code> | <code>x &amp; y</code> | <code>type(x).__and__(x, y)</code>      |
| <code>x   y</code>     | <code>x   y</code>     | <code>type(x).__or__(x, y)</code>       |
| <code>!x</code>        | <code>~x</code>        | <code>type(x).__not__(x)</code>         |
| <code>x %% y</code>    | <code>x @ y</code>     | <code>type(x).__matmul__(x, y)</code>   |

Note: If the initial Python method invoked raises a `NotImplementedException`, the Python interpreter will attempt to use the reflected variant of the method from the second argument. The arithmetic operators will call the equivalent double underscore (dunder) method with an "r" prefix. For instance, when evaluating the expression `x + y`, if `type(x).__add__(x, y)` raises a `NotImplementedException`, then the interpreter will attempt `type(y).__radd__(y, x)`. The comparison operators follow a different sequence of fallbacks; refer to the Python documentation for more details.

---

array\_reshape

*Reshape an Array*


---

## Description

Reshape (reindex) a multi-dimensional array, using row-major (C-style) reshaping semantics by default.

## Usage

```
array_reshape(x, dim, order = c("C", "F"))
```

## Arguments

`x` An array

`dim` The new dimensions to be set on the array.

**order** The order in which elements of `x` should be read during the rearrangement. "C" means elements should be read in row-major order, with the last index changing fastest; "F" means elements should be read in column-major order, with the first index changing fastest.

### Details

This function differs from e.g. `dim(x) <- dim` in a very important way: by default, `array_reshape()` will fill the new dimensions in row-major (C-style) ordering, while `dim<-()` will fill new dimensions in column-major (Fortran-style) ordering. This is done to be consistent with libraries like NumPy, Keras, and TensorFlow, which default to this sort of ordering when reshaping arrays. See the examples for why this difference may be important.

### Examples

```
## Not run:
# let's construct a 2x2 array from a vector of 4 elements
x <- 1:4

# rearrange will fill the array row-wise
array_reshape(x, c(2, 2))
#      [,1] [,2]
# [1,]  1  2
# [2,]  3  4
# setting the dimensions 'fills' the array col-wise
dim(x) <- c(2, 2)
x
#      [,1] [,2]
# [1,]  1  3
# [2,]  2  4

## End(Not run)
```

---

as.character.python.builtin.bytes

*Convert Python bytes to an R character vector*

---

### Description

Convert Python bytes to an R character vector

### Usage

```
## S3 method for class 'python.builtin.bytes'
as.character(x, encoding = "utf-8", errors = "strict", ...)
```

**Arguments**

|          |   |
|----------|---|
| x        | object to be coerced or tested.   |
| encoding | Encoding to use for conversion (defaults to utf-8)  |
| errors   | Policy for handling conversion errors. Default is 'strict' which raises an error. Other possible values are 'ignore' and 'replace'. |
| ...      | further arguments passed to or from other methods.  |

---

|             |  |
|-------------|--|
| as_iterator | <i>Traverse a Python iterator or generator</i> |
|-------------|--|

---

**Description**

Traverse a Python iterator or generator

**Usage**

```
as_iterator(x)

iterate(it, f = base::identity, simplify = TRUE)

iter_next(it, completed = NULL)
```

**Arguments**

|           |   |
|-----------|---|
| x         | Python iterator or iterable   |
| it        | Python iterator or generator  |
| f         | Function to apply to each item. By default applies the <code>identity</code> function which just reflects back the value of the item.                 |
| simplify  | Should the result be simplified to a vector if possible?  |
| completed | Sentinel value to return from <code>iter_next()</code> if the iteration completes (defaults to <code>NULL</code> but can be any R value you specify). |

**Details**

Simplification is only attempted all elements are length 1 vectors of type "character", "complex", "double", "integer", or "logical".

**Value**

For `iterate()`, A list or vector containing the results of calling `f` on each item in `x` (invisibly); For `iter_next()`, the next value in the iteration (or the sentinel `completed` value if the iteration is complete).

---

`conda-tools`*Conda Tools*

---

**Description**

Tools for managing Python conda environments.

**Usage**

```
conda_list(conda = "auto")

conda_create(
  envname = NULL,
  packages = NULL,
  ...,
  forge = TRUE,
  channel = character(),
  environment = NULL,
  conda = "auto",
  python_version = miniconda_python_version(),
  additional_create_args = character()
)

conda_clone(envname, ..., clone = "base", conda = "auto")

conda_export(
  envname,
  file = if (json) "environment.json" else "environment.yml",
  json = FALSE,
  ...,
  conda = "auto"
)

conda_remove(envname, packages = NULL, conda = "auto")

conda_install(
  envname = NULL,
  packages,
  forge = TRUE,
  channel = character(),
  pip = FALSE,
  pip_options = character(),
  pip_ignore_installed = FALSE,
  conda = "auto",
  python_version = NULL,
  additional_create_args = character(),
  additional_install_args = character(),
```



```

    ...
)

conda_binary(conda = "auto")

conda_exe(conda = "auto")

conda_version(conda = "auto")

conda_update(conda = "auto")

conda_python(envname = NULL, conda = "auto", all = FALSE)

conda_search(
  matchspec,
  forge = TRUE,
  channel = character(),
  conda = "auto",
  ...
)

condaenv_exists(envname = NULL, conda = "auto")

```

## Arguments

|                        |   |
|------------------------|---|
| conda                  | The path to a conda executable. Use "auto" to allow reticulate to automatically find an appropriate conda binary. See <b>Finding Conda</b> and <code>conda_binary()</code> for more details.  |
| envname                | The name of, or path to, a conda environment.   |
| packages               | A character vector, indicating package names which should be installed or removed. Use <package>==<version> to request the installation of a specific version of a package. A NULL value for <code>conda_remove()</code> will be interpreted to "--all", removing the entire environment. |
| ...                    | Optional arguments, reserved for future expansion.  |
| forge                  | Boolean; include the <b>conda-forge</b> repository?   |
| channel                | An optional character vector of conda channels to include. When specified, the forge argument is ignored. If you need to specify multiple channels, including the conda forge, you can use c("conda-forge", <other channels>).  |
| environment            | The path to an environment definition, generated via (for example) <code>conda_export()</code> , or via <code>conda env export</code> . When provided, the conda environment will be created using this environment definition, and other arguments will be ignored.                      |
| python_version         | The version of Python to be installed. Set this if you'd like to change the version of Python associated with a particular conda environment.   |
| additional_create_args | An optional character vector of additional arguments to use in the call to <code>conda create</code> .  |
| clone                  | The name of the conda environment to be cloned.   |

|                                      |  |
|--------------------------------------|--|
| <code>file</code>                    | The path where the conda environment definition will be written.   |
| <code>json</code>                    | Boolean; should the environment definition be written as JSON? By default, conda exports environments as YAML.   |
| <code>pip</code>                     | Boolean; use pip for package installation? By default, packages are installed from the active conda channels.  |
| <code>pip_options</code>             | An optional character vector of additional command line arguments to be passed to pip. Only relevant when <code>pip = TRUE</code> .  |
| <code>pip_ignore_installed</code>    | Ignore already-installed versions when using pip? (defaults to <code>FALSE</code> ). Set this to <code>TRUE</code> so that specific package versions can be installed even if they are downgrades. The <code>FALSE</code> option is useful for situations where you don't want a pip install to attempt an overwrite of a conda binary package (e.g. SciPy on Windows which is very difficult to install via pip due to compilation requirements). |
| <code>additional_install_args</code> | An optional character vector of additional arguments to use in the call to <code>conda install</code> .  |
| <code>all</code>                     | Boolean; report all instances of Python found?   |
| <code>matchspec</code>               | A conda MatchSpec query string.  |

### Value

`conda_list()` returns an R data frame, with `name` giving the name of the associated environment, and `python` giving the path to the Python binary associated with that environment.

`conda_create()` returns the path to the Python binary associated with the newly-created conda environment.

`conda_clone()` returns the path to Python within the newly-created conda environment.

`conda_export()` returns the path to the exported environment definition, invisibly.

`conda_search()` returns an R data frame describing packages that matched against `matchspec`. The data frame will usually include fields `name` giving the package name, `version` giving the package version, `build` giving the package build, and `channel` giving the channel the package is hosted on.

### Finding Conda

Most of `reticulate`'s conda APIs accept a `conda` parameter, used to control the conda binary used in their operation. When `conda = "auto"`, `reticulate` will attempt to automatically find a conda installation. The following locations are searched, in order:

1. The location specified by the `reticulate.conda_binary` R option,
2. The location specified by the `RETICULATE_CONDA` environment variable,
3. The `miniconda_path()` location (if it exists),
4. The program `PATH`,
5. A set of pre-defined locations where conda is typically installed.

To force `reticulate` to use a particular conda binary, we recommend setting:

```
options(reticulate.conda_binary = "/path/to/conda")
```

This can be useful if your conda installation lives in a location that `reticulate` is unable to automatically discover.

---

configure\_environment *Configure a Python Environment*

---

### Description

Configure a Python environment, satisfying the Python dependencies of any loaded R packages.

### Usage

```
configure_environment(package = NULL, force = FALSE)
```

### Arguments

|         |  |
|---------|--|
| package | The name of a package to configure. When NULL, <code>reticulate</code> will instead look at all loaded packages and discover their associated Python requirements.   |
| force   | Boolean; force configuration of the Python environment? Note that <code>configure_environment()</code> is a no-op within non-interactive R sessions. Use this if you require automatic environment configuration, e.g. when testing a package on a continuous integration service. |

### Details

Normally, this function should only be used by package authors, who want to ensure that their package dependencies are installed in the active Python environment. For example:

```
.onLoad <- function(libname, pkgname) {  
  reticulate::configure_environment(pkgname)  
}
```

If the Python session has not yet been initialized, or if the user is not using the default Miniconda Python installation, no action will be taken. Otherwise, `reticulate` will take this as a signal to install any required Python dependencies into the user's Python environment.

If you'd like to disable `reticulate`'s auto-configure behavior altogether, you can set the environment variable:

```
RETICULATE_AUTOCONFIGURE = FALSE
```

e.g. in your `~/.Renvi` or similar.

Note that, in the case where the Python session has not yet been initialized, `reticulate` will automatically ensure your required Python dependencies are installed after the Python session is initialized (when appropriate).

---

dict *Create Python dictionary*

---

### Description

Create a Python dictionary object, including a dictionary whose keys are other Python objects rather than character vectors.

### Usage

```
dict(..., convert = FALSE)

py_dict(keys, values, convert = FALSE)
```

### Arguments

|         |  |
|---------|--|
| ...     | Name/value pairs for dictionary (or a single named list to be converted to a dictionary).  |
| convert | TRUE to automatically convert Python objects to their R equivalent. If you pass FALSE you can do manual conversion using the <a href="#">py_to_r()</a> function. |
| keys    | Keys to dictionary (can be Python objects)   |
| values  | Values for dictionary  |

### Value

A Python dictionary

### Note

The returned dictionary will not automatically convert its elements from Python to R. You can do manual conversion with the [py\\_to\\_r\(\)](#) function or pass `convert = TRUE` to request automatic conversion.

---

eng\_python *A reticulate Engine for Knitr*

---

### Description

This provides a reticulate engine for knitr, suitable for usage when attempting to render Python chunks. Using this engine allows for shared state between Python chunks in a document – that is, variables defined by one Python chunk can be used by later Python chunks.

### Usage

```
eng_python(options)
```

## Arguments

options            Chunk options, as provided by knitr during chunk execution.

## Details

The engine can be activated by setting (for example)

```
knitr::knit_engines$set(python = reticulate::eng_python)
```

Typically, this will be set within a document's setup chunk, or by the environment requesting that Python chunks be processed by this engine. Note that knitr (since version 1.18) will use the reticulate engine by default when executing Python chunks within an R Markdown document.

## Supported knitr chunk options

For most options, reticulate's python engine behaves the same as the default R engine included in knitr, but they might not support all the same features. Options in *italic* are equivalent to knitr, but with modified behavior.

- `eval` (TRUE, logical): If TRUE, all expressions in the chunk are evaluated. If FALSE, no expression is evaluated. Unlike knitr's R engine, it doesn't support numeric values indicating the expressions to evaluate.
- `echo` (TRUE, logical): Whether to display the source code in the output document. Unlike knitr's R engine, it doesn't support numeric values indicating the expressions to display.
- `results` ('markup', character): Controls how to display the text results. Note that this option only applies to normal text output (not warnings, messages, or errors). The behavior should be identical to knitr's R engine.
- `collapse` (FALSE, logical): Whether to, if possible, collapse all the source and output blocks from one code chunk into a single block (by default, they are written to separate blocks). This option only applies to Markdown documents.
- `error` (TRUE, logical): Whether to preserve errors. If FALSE evaluation stops on errors. (Note that RMarkdown sets it to FALSE).
- `warning` (TRUE, logical): Whether to preserve warnings in the output. If FALSE, all warnings will be suppressed. Doesn't support indices.
- `include` (TRUE, logical): Whether to include the chunk output in the output document. If FALSE, nothing will be written into the output document, but the code is still evaluated and plot files are generated if there are any plots in the chunk, so you can manually insert figures later.
- `dev`: The graphical device to generate plot files. See knitr documentation for additional information.
- `base.dir` (NULL; character): An absolute directory under which the plots are generated.
- `strip.white` (TRUE; logical): Whether to remove blank lines in the beginning or end of a source code block in the output.
- `dpi` (72; numeric): The DPI (dots per inch) for bitmap devices ( $\text{dpi} * \text{inches} = \text{pixels}$ ).
- `fig.width`, `fig.height` (both are 7; numeric): Width and height of the plot (in inches), to be used in the graphics device.

- `label`: The chunk label for each chunk is assumed to be unique within the document. This is especially important for cache and plot filenames, because these filenames are based on chunk labels. Chunks without labels will be assigned labels like `unnamed-chunk-i`, where `i` is an incremental number.

#### Python engine only options:

- `jupyter_compat` (FALSE, logical): If TRUE then, like in Jupyter notebooks, only the last expression in the chunk is printed to the output.
- `out.width.px`, `out.height.px` (810, 400, both integers): Width and height of the plot in the output document, which can be different with its physical `fig.width` and `fig.height`, i.e., plots can be scaled in the output document. Unlike knitr's `out.width`, this is always set in pixels.
- `altair.fig.width`, `altair.fig.height`: If set, is used instead of `out.width.px` and `out.height.px` when writing Altair charts.

---

|                     |                               |
|---------------------|-------------------------------|
| <code>import</code> | <i>Import a Python module</i> |
|---------------------|-------------------------------|

---

#### Description

Import the specified Python module, making it available for use from R.

#### Usage

```
import(module, as = NULL, convert = TRUE, delay_load = FALSE)
```

```
import_main(convert = TRUE, delay_load = FALSE)
```

```
import_builtins(convert = TRUE, delay_load = FALSE)
```

```
import_from_path(module, path = ".", convert = TRUE, delay_load = FALSE)
```

#### Arguments

|                         |   |
|-------------------------|---|
| <code>module</code>     | The name of the Python module.  |
| <code>as</code>         | An alias for module name (affects names of R classes). Note that this is an advanced parameter that should generally only be used in package development (since it affects the S3 name of the imported class and can therefore interfere with S3 method dispatching). |
| <code>convert</code>    | Boolean; should Python objects be automatically converted to their R equivalent? If set to FALSE, you can still manually convert Python objects to R via the <code>py_to_r()</code> function.   |
| <code>delay_load</code> | Boolean; delay loading the module until it is first used? When FALSE, the module will be loaded immediately. See <b>Delay Load</b> for advanced usages.   |
| <code>path</code>       | The path from which the module should be imported.  |

**Value**

An R object wrapping a Python module. Module attributes can be accessed via the \$ operator, or via `py_get_attr()`.

**Python Built-ins**

Python's built-in functions (e.g. `len()`) can be accessed via Python's built-in module. Because the name of this module has changed between Python 2 and Python 3, we provide the function `import_builtins()` to abstract over that name change.

**Delay Load**

The `delay_load` parameter accepts a variety of inputs. If you just need to ensure your module is lazy-loaded (e.g. because you are a package author and want to avoid initializing Python before the user has explicitly requested it), then passing `TRUE` is normally the right choice.

You can also provide a named list: "before\_load", "on\_load" and "on\_error" can be functions, which act as callbacks to be run when the module is later loaded. "environment" can be a character vector of preferred python environment names to search for and use. For example:

```
delay_load = list(
  # run before the module is loaded
  before_load = function() { ... }

  # run immediately after the module is loaded
  on_load = function() { ... }

  # run if an error occurs during module import
  on_error = function(error) { ... }

  environment = c("r-preferred-venv1", "r-preferred-venv2")
)
```

Alternatively, if you supply only a single function, that will be treated as an `on_load` handler.

**Import from Path**

`import_from_path()` can be used if you need to import a module from an arbitrary filesystem path. This is most commonly used when importing modules bundled with an R package – for example:

```
path <- system.file("python", package = <package>)
reticulate::import_from_path(<module>, path = path, delay_load = TRUE)
```

**Examples**

```
## Not run:
main <- import_main()
```

```
sys <- import("sys")  
## End(Not run)
```

---

|                   |                          |
|-------------------|--------------------------|
| install_miniconda | <i>Install Miniconda</i> |
|-------------------|--------------------------|

---

### Description

Download the [Miniconda](#) installer, and use it to install Miniconda.

### Usage

```
install_miniconda(path = miniconda_path(), update = TRUE, force = FALSE)
```

### Arguments

|        |   |
|--------|---|
| path   | The location where Miniconda is (or should be) installed. Note that the Miniconda installer does not support paths containing spaces. See <a href="#">miniconda_path</a> for more details on the default path used by reticulate. |
| update | Boolean; update to the latest version of Miniconda after installation?  |
| force  | Boolean; force re-installation if Miniconda is already installed at the requested path?   |

### Details

For arm64 builds of R on macOS, `install_miniconda()` will use binaries from [miniforge](#) instead.

### Note

If you encounter binary incompatibilities between R and Miniconda, a scripted build and installation of Python from sources can be performed by [install\\_python\(\)](#)

### See Also

Other miniconda-tools: [miniconda\\_uninstall\(\)](#), [miniconda\\_update\(\)](#)



---

|                |                       |
|----------------|-----------------------|
| install_python | <i>Install Python</i> |
|----------------|-----------------------|

---

## Description

Download and install Python, using the [pyenv](#). and [pyenv-win](#) projects.

## Usage

```
install_python(  
  version = "3.10:latest",  
  list = FALSE,  
  force = FALSE,  
  optimized = TRUE  
)
```

## Arguments

|           |   |
|-----------|---|
| version   | The version of Python to install.   |
| list      | Boolean; if set, list the set of available Python versions?   |
| force     | Boolean; force re-installation even if the requested version of Python is already installed?  |
| optimized | Boolean; if TRUE, installation will take significantly longer but should result in a faster Python interpreter. Only applicable on macOS and Linux. |

## Details

In general, it is recommended that Python virtual environments are created using the copies of Python installed by [install\\_python\(\)](#). For example:

```
library(reticulate)  
version <- "3.9.12"  
install_python(version)  
virtualenv_create("my-environment", version = version)  
use_virtualenv("my-environment")  
  
# There is also support for a ":latest" suffix to select the latest patch release  
install_python("3.9:latest") # install latest patch available at python.org  
  
# select the latest 3.9.* patch installed locally  
virtualenv_create("my-environment", version = "3.9:latest")
```

**Note**

On macOS and Linux this will build Python from sources, which may take a few minutes. Installation will be faster if some build dependencies are preinstalled. See <https://github.com/pyenv/pyenv/wiki#suggested-build-environment> for example commands you can run to pre-install system dependencies (requires administrator privileges).

If `optimized = TRUE`, (the default) Python is build with:

```
PYTHON_CONFIGURE_OPTS="--enable-shared --enable-optimizations --with-lto"
PYTHON_CFLAGS="-march=native -mtune=native"
```

If `optimized = FALSE`, Python is built with:

```
PYTHON_CONFIGURE_OPTS=--enable-shared
```

On Windows, prebuilt installers from <https://www.python.org> are used.

---

|                             |                          |
|-----------------------------|--------------------------|
| <code>miniconda_path</code> | <i>Path to Miniconda</i> |
|-----------------------------|--------------------------|

---

**Description**

The path to the Miniconda installation to use. By default, an OS-specific path is used. If you'd like to instead set your own path, you can set the `RETICULATE_MINICONDA_PATH` environment variable.

**Usage**

```
miniconda_path()
```

---

|                                  |                         |
|----------------------------------|-------------------------|
| <code>miniconda_uninstall</code> | <i>Remove Miniconda</i> |
|----------------------------------|-------------------------|

---

**Description**

Uninstall Miniconda.

**Usage**

```
miniconda_uninstall(path = miniconda_path())
```

**Arguments**

|                   |   |
|-------------------|---|
| <code>path</code> | The path in which Miniconda is installed. |
|-------------------|---|

**See Also**

Other miniconda-tools: [install\\_miniconda\(\)](#), [miniconda\\_update\(\)](#)

---

|                  |                         |
|------------------|-------------------------|
| miniconda_update | <i>Update Miniconda</i> |
|------------------|-------------------------|

---

**Description**

Update Miniconda to the latest version.

**Usage**

```
miniconda_update(path = miniconda_path())
```

**Arguments**

|      |   |
|------|---|
| path | The location where Miniconda is (or should be) installed. Note that the Miniconda installer does not support paths containing spaces. See <a href="#">miniconda_path</a> for more details on the default path used by reticulate. |
|------|---|

**See Also**

Other miniconda-tools: [install\\_miniconda\(\)](#), [miniconda\\_uninstall\(\)](#)

---

```
nameOfClass.python.builtin.type
nameOfClass() for Python objects
```

---

**Description**

This generic enables passing a `python.builtin.type` object as the 2nd argument to `base::inherits()`.

**Usage**

```
## S3 method for class 'python.builtin.type'
nameOfClass(x)
```

**Arguments**

|   |                |
|---|----------------|
| x | A Python class |
|---|----------------|

**Value**

A scalar string matching the S3 class of objects constructed from the type.

**Examples**

```
## Not run:
numpy <- import("numpy")
x <- r_to_py(array(1:3))
inherits(x, numpy$ndarray)

## End(Not run)
```

---

`np_array`*NumPy array*

---

**Description**

Create NumPy arrays and convert the data type and in-memory ordering of existing NumPy arrays.

**Usage**

```
np_array(data, dtype = NULL, order = "C")
```

**Arguments**

|                    |  |
|--------------------|--|
| <code>data</code>  | Vector or existing NumPy array providing data for the array            |
| <code>dtype</code> | Numpy data type (e.g. "float32", "float64", etc.)                      |
| <code>order</code> | Memory ordering for array. "C" means C order, "F" means Fortran order. |

**Value**

A NumPy array object.

---

`py`*Interact with the Python Main Module*

---

**Description**

The `py` object provides a means for interacting with the Python main session directly from R. Python objects accessed through `py` are automatically converted into R objects, and can be used with any other R functions as needed.

**Usage**

```
py
```

**Format**

An R object acting as an interface to the Python main module.

---

|         |                              |
|---------|------------------------------|
| PyClass | <i>Create a python class</i> |
|---------|------------------------------|

---

**Description**

Create a python class

**Usage**

```
PyClass(classname, defs = list(), inherit = NULL)
```

**Arguments**

|           |   |
|-----------|---|
| classname | Name of the class. The class name is useful for S3 method dispatch.                                       |
| defs      | A named list of class definitions - functions, attributes, etc.   |
| inherit   | A list of Python class objects. Usually these objects have the <code>python.builtin.type</code> S3 class. |

**Examples**

```
## Not run:
Hi <- PyClass("Hi", list(
  name = NULL,
  `__init__` = function(self, name) {
    self$name <- name
    NULL
  },
  say_hi = function(self) {
    paste0("Hi ", self$name)
  }
))

a <- Hi("World")

## End(Not run)
```

---

|              |  |
|--------------|--|
| py_available | <i>Check if Python is available on this system</i> |
|--------------|--|

---

**Description**

Check if Python is available on this system

**Usage**

```
py_available(initialize = FALSE)
```

```
py_numpy_available(initialize = FALSE)
```

**Arguments**

`initialize` TRUE to attempt to initialize Python bindings if they aren't yet available (defaults to FALSE).

**Value**

Logical indicating whether Python is initialized.

**Note**

The `py_numpy_available` function is a superset of the `py_available` function (it calls `py_available` first before checking for NumPy).

---

py\_bool

*Python Truthiness*

---

**Description**

Equivalent to `bool(x)` in Python, or `not not x`.

**Usage**

```
py_bool(x)
```

**Arguments**

`x` A python object.

**Details**

If the Python object defines a `__bool__` method, then that is invoked. Otherwise, if the object defines a `__len__` method, then TRUE is returned if the length is nonzero. If neither `__len__` nor `__bool__` are defined, then the Python object is considered TRUE.

**Value**

An R scalar logical: TRUE or FALSE. If `x` is a null pointer or Python is not initialized, FALSE is returned.

---

py\_capture\_output      *Capture and return Python output*

---

**Description**

Capture and return Python output

**Usage**

```
py_capture_output(expr, type = c("stdout", "stderr"))
```

**Arguments**

expr                  Expression to capture stdout for  
type                  Streams to capture (defaults to both stdout and stderr)

**Value**

Character vector with output

---

py\_clear\_last\_error      *Get or (re)set the last Python error encountered.*

---

**Description**

Get or (re)set the last Python error encountered.

**Usage**

```
py_clear_last_error()  
py_last_error(exception)
```

**Arguments**

exception              A python exception object. If provided, the provided exception is set as the last exception.

**Value**

For `py_last_error()`, NULL if no error has yet been encountered. Otherwise, a named list with entries:

- "type": R string, name of the exception class.
- "value": R string, formatted exception message.
- "traceback": R character vector, the formatted python traceback,
- "message": The full formatted raised exception, as it would be printed in Python. Includes the traceback, type, and value.
- "r\_trace": A data.frame with class `rlang_trace` and columns:
  - `call`: The R callstack, `full_call`, summarized for pretty printing.
  - `full_call`: The R callstack. (Output of `sys.calls()` at the error callsite).
  - `parent`: The parent of each frame in callstack. (Output of `sys.parents()` at the error callsite).
  - Additional columns for internals use: `namespace`, `visible`, `scope`.

And attribute "exception", a 'python.builtin.Exception' object.

The named list has class "py\_error", and has a default print method that is the equivalent of `cat(py_last_error()$message)`.

**Examples**

```
## Not run:

# see last python exception with R traceback
reticulate::py_last_error()

# see the full R callstack from the last Python exception
reticulate::py_last_error()$r_trace$full_call

# run python code that might error,
# without modifying the user-visible python exception

safe_len <- function(x) {
  last_err <- py_last_error()
  tryCatch({
    # this might raise a python exception if x has no `__len__` method.
    import_builtins()$len(x)
  }, error = function(e) {
    # py_last_error() was overwritten, is now "no len method for 'object'"
    py_last_error(last_err) # restore previous exception
    -1L
  })
}

safe_len(py_eval("object"))

## End(Not run)
```



---

|           |                             |
|-----------|-----------------------------|
| py_config | <i>Python configuration</i> |
|-----------|-----------------------------|

---

**Description**

Retrieve information about the version of Python currently being used by reticulate.

**Usage**

```
py_config()
```

**Details**

If Python has not yet been initialized, then calling `py_config()` will force the initialization of Python. See [py\\_discover\\_config\(\)](#) for more details.

**Value**

Information about the version of Python in use, as an R list with class "py\_config".

---

|             |   |
|-------------|---|
| py_del_attr | <i>Delete an attribute of a Python object</i> |
|-------------|---|

---

**Description**

Delete an attribute of a Python object

**Usage**

```
py_del_attr(x, name)
```

**Arguments**

|      |                     |
|------|---------------------|
| x    | A Python object.    |
| name | The attribute name. |

---

py\_discover\_config      *Discover the version of Python to use with reticulate.*

---

### Description

This function enables callers to check which versions of Python will be discovered on a system as well as which one will be chosen for use with reticulate.

### Usage

```
py_discover_config(required_module = NULL, use_environment = NULL)
```

### Arguments

required\_module

A optional module name that will be used to select the Python environment used.

use\_environment

An optional virtual/conda environment name to prefer in the search.

### Details

The order of discovery is documented in vignette("versions"), also available online [here](#)

### Value

Python configuration object.

---

py\_ellipsis      *The builtin constant Ellipsis*

---

### Description

The builtin constant Ellipsis

### Usage

```
py_ellipsis()
```

---

`py_eval`*Evaluate a Python Expression*

---

**Description**

Evaluate a single Python expression, in a way analogous to the Python `eval()` built-in function.

**Usage**

```
py_eval(code, convert = TRUE)
```

**Arguments**

|                      |   |
|----------------------|---|
| <code>code</code>    | A single Python expression.                         |
| <code>convert</code> | Boolean; automatically convert Python objects to R? |

**Value**

The result produced by evaluating `code`, converted to an R object when `convert` is set to `TRUE`.

**Caveats**

`py_eval()` only supports evaluation of 'simple' Python expressions. Other expressions (e.g. assignments) will fail; e.g.

```
> py_eval("x = 1")
Error in py_eval_impl(code, convert) :
  SyntaxError: invalid syntax (reticulate_eval, line 1)
```

and this mirrors what one would see in a regular Python interpreter:

```
>>> eval("x = 1")
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
  File "<string>", line 1
x = 1
^
SyntaxError: invalid syntax
```

The `py_run_string()` method can be used if the evaluation of arbitrary Python code is required.

---

 py\_exe

*Python executable*


---

**Description**

Get the path to the Python executable that `reticulate` has been configured to use. If Python has already been initialized, then `reticulate` will choose the currently-active copy of Python.

**Usage**

```
py_exe()
```

**Details**

This can occasionally be useful if you'd like to interact with Python (or its modules) via a subprocess; for example you might choose to install a package with `pip`:

```
system2(py_exe(), c("-m", "pip", "install", "numpy"))
```

and so you can also have greater control over how these modules are invoked.

**Value**

The path to the Python executable `reticulate` has been configured to use.

---

 py\_func

*Wrap an R function in a Python function with the same signature.*


---

**Description**

This function could wrap an R function in a Python function with the same signature. Note that the signature of the R function must not contain esoteric Python-incompatible constructs.

**Usage**

```
py_func(f)
```

**Arguments**

`f` An R function

**Value**

A Python function that calls the R function `f` with the same signature.

---

 py\_function\_custom\_scaffold

*Custom Scaffolding of R Wrappers for Python Functions*


---

## Description

This function can be used to generate R wrapper for a specified Python function while allowing to inject custom code for critical parts of the wrapper generation, such as process the any part of the docs obtained from `py_function_docs()` and append additional roxygen fields. The result from execution of `python_function` is assigned to a variable called `python_function_result` that can also be processed by `postprocess_fn` before writing the closing curly braces for the generated wrapper function.

## Usage

```
py_function_custom_scaffold(
  python_function,
  r_function = NULL,
  additional_roxygen_fields = NULL,
  process_docs_fn = function(docs) docs,
  process_param_fn = function(param, docs) param,
  process_param_doc_fn = function(param_doc, docs) param_doc,
  postprocess_fn = function() {
  },
  file_name = NULL
)
```

## Arguments

|  |   |
|--|---|
| <code>python_function</code>           | Fully qualified name of Python function or class constructor (e.g. <code>tf\$layers\$average_pooling1d</code> )                                 |
| <code>r_function</code>                | Name of R function to generate (defaults to name of Python function if not specified)   |
| <code>additional_roxygen_fields</code> | A list of additional roxygen fields to write to the roxygen docs, e.g. <code>list(export = "", rdname = "generated-wrappers")</code> .          |
| <code>process_docs_fn</code>           | A function to process docs obtained from <code>reticulate::py_function_docs(python_function)</code> .   |
| <code>process_param_fn</code>          | A function to process each parameter needed for <code>python_function</code> before executing <code>python_function</code> .                    |
| <code>process_param_doc_fn</code>      | A function to process the roxygen docstring for each parameter.   |
| <code>postprocess_fn</code>            | A function to inject any custom code in the form of a string before writing the closing curly braces for the generated wrapper function.        |
| <code>file_name</code>                 | The file name to write the generated wrapper function to. If <code>NULL</code> , the generated wrapper will only be printed out in the console. |

**Examples**

```
## Not run:

library(tensorflow)
library(stringr)

# Example of a `process_param_fn` to cast parameters with default values
# that contains "L" to integers
process_int_param_fn <- function(param, docs) {
  # Extract the list of parameters that have integer values as default
  int_params <- gsub(
    " = [-]?[0-9]+L",
    "",
    str_extract_all(docs$signature, "[A-z]+ = [-]?[0-9]+L")[[1]])
  # Explicitly cast parameter in the list obtained above to integer
  if (param %in% int_params) {
    param <- paste0("as.integer(", param, ")")
  }
  param
}

# Note that since the default value of parameter `k` is `1L`. It is wrapped
# by `as.integer()` to ensure it's casted to integer before sending it to `tf$nn$top_k`
# for execution. We then print out the python function result.
py_function_custom_scaffold(
  "tf$nn$top_k",
  r_function = "top_k",
  process_param_fn = process_int_param_fn,
  postprocess_fn = function() { "print(python_function_result)" })

## End(Not run)
```

---

py\_get\_attr

*Get an attribute of a Python object*


---

**Description**

Get an attribute of a Python object

**Usage**

```
py_get_attr(x, name, silent = FALSE)
```

**Arguments**

|        |   |
|--------|---|
| x      | Python object   |
| name   | Attribute name  |
| silent | TRUE to return NULL if the attribute doesn't exist (default is FALSE which will raise an error) |

**Value**

Attribute of Python object

---

|             |  |
|-------------|--|
| py_get_item | <i>Get/Set/Delete an item from a Python object</i> |
|-------------|--|

---

**Description**

Access an item from a Python object, similar to how `x[key]` might be used in Python code to access an item indexed by key on an object `x`. The object's `__getitem__()` `__setitem__()` or `__delitem__()` method will be called.

**Usage**

```
py_get_item(x, key, silent = FALSE)

py_set_item(x, key, value)

py_del_item(x, key)

## S3 method for class 'python.builtin.object'
x[...]

## S3 replacement method for class 'python.builtin.object'
x[...] <- value
```

**Arguments**

|                       |  |
|-----------------------|--|
| <code>x</code>        | A Python object.   |
| <code>key, ...</code> | The key used for item lookup.  |
| <code>silent</code>   | Boolean; when TRUE, attempts to access missing items will return NULL rather than throw an error.  |
| <code>value</code>    | The item value to set. Assigning value of NULL calls <code>py_del_item()</code> and is equivalent to the python expression <code>del x[key]</code> . To set an item value of None, you can call <code>py_set_item()</code> directly, or call <code>x[key] &lt;- py_none()</code> |

**Value**

For `py_get_item()` and `[]`, the return value from the `x.__getitem__()` method. For `py_set_item()`, `py_del_item()` and `[<-`, the mutate object `x` is returned.

**Note**

The `py_get_item()` always returns an unconverted python object, while `[]` will automatically attempt to convert the object if `x` was created with `convert = TRUE`.

**Examples**

```
## Not run:

## get/set/del item from Python dict
x <- r_to_py(list(abc = "xyz"))

#' # R expression | Python expression
# ----- | -----
x["abc"]          # x["abc"]
x["abc"] <- "123" # x["abc"] = "123"
x["abc"] <- NULL  # del x["abc"]
x["abc"] <- py_none() # x["abc"] = None

## get item from Python list
x <- r_to_py(list("a", "b", "c"))
x[0]

## slice a NumPy array
x <- np_array(array(1:64, c(4, 4, 4)))

# R expression | Python expression
# ----- | -----
x[0]          # x[0]
x[, 0]        # x[:, 0]
x[, , 0]      # x[:, :, 0]

x[NA:2]       # x[:2]
x[`^:2`]     # x[:2]

x[2:NA]       # x[2:]
x[2:`^`]     # x[2:]

x[NA:NA:2]    # x[:, :2]
x[`^::2`]    # x[:, :2]

x[1:3:2]      # x[1:3:2]
x[1:3:2`]    # x[1:3:2]

## End(Not run)
```

---

py\_has\_attr

*Check if a Python object has an attribute*


---

**Description**

Check whether a Python object `x` has an attribute `name`.

**Usage**

```
py_has_attr(x, name)
```



**Arguments**

|      |                               |
|------|-------------------------------|
| x    | A python object.              |
| name | The attribute to be accessed. |

**Value**

TRUE if the object has the attribute name, and FALSE otherwise.

---

 py\_help

*Documentation for Python Objects*


---

**Description**

Documentation for Python Objects

**Usage**

py\_help(object)

**Arguments**

|        |                                   |
|--------|-----------------------------------|
| object | Object to print documentation for |
|--------|-----------------------------------|

---

 py\_id

*Unique identifier for Python object*


---

**Description**

Get a globally unique identifier for a Python object.

**Usage**

py\_id(object)

**Arguments**

|        |               |
|--------|---------------|
| object | Python object |
|--------|---------------|

**Value**

Unique identifier (as string) or NULL

**Note**

In the current implementation of CPython this is the memory address of the object.

py\_install

*Install Python packages***Description**

Install Python packages into a virtual environment or Conda environment.

**Usage**

```
py_install(
  packages,
  envname = NULL,
  method = c("auto", "virtualenv", "conda"),
  conda = "auto",
  python_version = NULL,
  pip = FALSE,
  ...,
  pip_ignore_installed = ignore_installed,
  ignore_installed = FALSE
)
```

**Arguments**

|  |   |
|--|---|
| packages                               | A vector of Python packages to install.   |
| envname                                | The name, or full path, of the environment in which Python packages are to be installed. When NULL (the default), the active environment as set by the RETICULATE_PYTHON_ENV variable will be used; if that is unset, then the <code>r-reticulate</code> environment will be used.  |
| method                                 | Installation method. By default, "auto" automatically finds a method that will work in the local environment. Change the default to force a specific installation method. Note that the "virtualenv" method is not available on Windows.  |
| conda                                  | The path to a conda executable. Use "auto" to allow <code>reticulate</code> to automatically find an appropriate conda binary. See <b>Finding Conda</b> and <a href="#">conda_binary()</a> for more details.  |
| python_version                         | The requested Python version. Ignored when attempting to install with a Python virtual environment.   |
| pip                                    | Boolean; use pip for package installation? This is only relevant when Conda environments are used, as otherwise packages will be installed from the Conda repositories.   |
| ...                                    | Additional arguments passed to <a href="#">conda_install()</a> or <a href="#">virtualenv_install()</a> .  |
| pip_ignore_installed, ignore_installed | Boolean; whether pip should ignore previously installed versions of the requested packages. Setting this to TRUE causes pip to install the latest versions of all dependencies into the requested environment. This ensure that no dependencies are satisfied by a package that exists either in the site library or was previously installed from a different—potentially incompatible—distribution channel. |

(ignore\_installed is an alias for pip\_ignore\_installed, pip\_ignore\_installed takes precedence).

### Details

On Linux and OS X the "virtualenv" method will be used by default ("conda" will be used if virtualenv isn't available). On Windows, the "conda" method is always used.

### See Also

[conda\\_install\(\)](#), for installing packages into conda environments. [virtualenv\\_install\(\)](#), for installing packages into virtual environments.

---

|                 |   |
|-----------------|---|
| py_is_null_xptr | <i>Check if a Python object is a null externalptr</i> |
|-----------------|---|

---

### Description

Check if a Python object is a null externalptr

### Usage

```
py_is_null_xptr(x)
py_validate_xptr(x)
```

### Arguments

|   |               |
|---|---------------|
| x | Python object |
|---|---------------|

### Details

When Python objects are serialized within a persisted R environment (e.g. .RData file) they are deserialized into null externalptr objects (since the Python session they were originally connected to no longer exists). This function allows you to safely check whether whether a Python object is a null externalptr.

The py\_validate function is a convenience function which calls py\_is\_null\_xptr and throws an error in the case that the xptr is NULL.

### Value

Logical indicating whether the object is a null externalptr

---

`py_iterator`*Create a Python iterator from an R function*

---

**Description**

Create a Python iterator from an R function

**Usage**

```
py_iterator(fn, completed = NULL, prefetch = 0L)
```

**Arguments**

|                        |   |
|------------------------|---|
| <code>fn</code>        | R function with no arguments.   |
| <code>completed</code> | Special sentinel return value which indicates that iteration is complete (defaults to NULL).  |
| <code>prefetch</code>  | Number items to prefetch. Set this to a positive integer to avoid a deadlock in situations where the generator values are consumed by python background threads while the main thread is blocked. |

**Details**

Python generators are functions that implement the Python iterator protocol. In Python, values are returned using the `yield` keyword. In R, values are simply returned from the function.

In Python, the `yield` keyword enables successive iterations to use the state of previous iterations. In R, this can be done by returning a function that mutates its enclosing environment via the `<<-` operator. For example:

```
sequence_generator <- function(start) {  
  value <- start  
  function() {  
    value <<- value + 1  
    value  
  }  
}
```

Then create an iterator using `py_iterator()`:

```
g <- py_iterator(sequence_generator(10))
```

**Value**

Python iterator which calls the R function for each iteration.

**Ending Iteration**

In Python, returning from a function without calling `yield` indicates the end of the iteration. In R however, `return` is used to yield values, so the end of iteration is indicated by a special return value (NULL by default, however this can be changed using the `completed` parameter). For example:

```
sequence_generator <-function(start) {
  value <- start
  function() {
    value <<- value + 1
    if (value < 100)
      value
    else
      NULL
  }
}
```

**Threading**

Some Python APIs use generators to parallelize operations by calling the generator on a background thread and then consuming its results on the foreground thread. The `py_iterator()` function creates threadsafe iterators by ensuring that the R function is always called on the main thread (to be compatible with R's single-threaded runtime) even if the generator is run on a background thread.

---

|                     |                                |
|---------------------|--------------------------------|
| <code>py_len</code> | <i>Length of Python object</i> |
|---------------------|--------------------------------|

---

**Description**

Get the length of a Python object. This is equivalent to calling the Python builtin `len()` function on the object.

**Usage**

```
py_len(x, default = NULL)
```

**Arguments**

|                      |   |
|----------------------|---|
| <code>x</code>       | A Python object.  |
| <code>default</code> | The default length value to return, in the case that the associated Python object has no <code>__len__</code> method. When NULL (the default), an error is emitted instead. |

**Details**

Not all Python objects have a defined length. For objects without a defined length, calling `py_len()` will throw an error. If you'd like to instead infer a default length in such cases, you can set the `default` argument to e.g. `1L`, to treat Python objects without a `__len__` method as having length one.

**Value**

The length of the object, as a numeric value.

---

py\_list\_attributes      *List all attributes of a Python object*

---

**Description**

List all attributes of a Python object

**Usage**

```
py_list_attributes(x)
```

**Arguments**

x                      Python object

**Value**

Character vector of attributes

---

py\_list\_packages      *List installed Python packages*

---

**Description**

List the Python packages that are installed in the requested Python environment.

**Usage**

```
py_list_packages(
  envname = NULL,
  type = c("auto", "virtualenv", "conda"),
  python = NULL
)
```

**Arguments**

envname                The name of, or path to, a Python virtual environment. Ignored when python is non-NULL.

type                    The virtual environment type. Useful if you have both virtual environments and Conda environments of the same name on your system, and you need to disambiguate them.

python                 The path to a Python executable.

**Details**

When `envname` is `NULL`, `reticulate` will use the "default" version of Python, as reported by `py_exe()`. This implies that you can call `py_list_packages()` without arguments in order to list the installed Python packages in the version of Python currently used by `reticulate`.

**Value**

An R `data.frame`, with columns:

`package` The package name.

`version` The package version.

`requirement` The package requirement.

`channel` (Conda only) The channel associated with this package.

---

`py_main_thread_func` *Create a Python function that will always be called on the main thread*

---

**Description**

This function is helpful when you need to provide a callback to a Python library which may invoke the callback on a background thread. As R functions must run on the main thread, wrapping the R function with `py_main_thread_func()` will ensure that R code is only executed on the main thread.

**Usage**

```
py_main_thread_func(f)
```

**Arguments**

`f` An R function with arbitrary arguments

**Value**

A Python function that delegates to the passed R function, which is guaranteed to always be called on the main thread.

---

py\_module\_available     *Check if a Python module is available on this system.*

---

### Description

Note that this function will also attempt to initialize Python before checking if the requested module is available.

### Usage

```
py_module_available(module)
```

### Arguments

module                    The name of the module.

### Value

TRUE if the module is available and can be loaded; FALSE otherwise.

---

py\_none                    *The Python None object*

---

### Description

Get a reference to the Python None object.

### Usage

```
py_none()
```

---

py\_repr                    *String representation of a python object.*

---

### Description

This is equivalent to calling `str(object)` or `repr(object)` in Python.

### Usage

```
py_repr(object)
```

```
py_str(object, ...)
```



**Arguments**

|        |               |
|--------|---------------|
| object | Python object |
| ...    | Unused        |

**Details**

In Python, calling `print()` invokes the builtin `str()`, while auto-printing an object at the REPL invokes the builtin `repr()`.

In R, the default print method for python objects invokes `py_repr()`, and the default `format()` and `as.character()` methods invoke `py_str()`.

For historical reasons, `py_str()` is also an R S3 method that allows R authors to customize the the string representation of a Python object from R. New code is recommended to provide a `format()` and/or `print()` S3 R method for python objects instead.

The default implementation will call `PyObject_Str` on the object.

**Value**

Character vector

---

|        |                        |
|--------|------------------------|
| py_run | <i>Run Python code</i> |
|--------|------------------------|

---

**Description**

Execute code within the scope of the `__main__` Python module.

**Usage**

```
py_run_string(code, local = FALSE, convert = TRUE)
```

```
py_run_file(file, local = FALSE, convert = TRUE, prepend_path = TRUE)
```

**Arguments**

|              |   |
|--------------|---|
| code         | The Python code to be executed.   |
| local        | Boolean; should Python objects be created as part of a local / private dictionary? If FALSE, objects will be created within the scope of the Python main module.                              |
| convert      | Boolean; should Python objects be automatically converted to their R equivalent? If set to FALSE, you can still manually convert Python objects to R via the <code>py_to_r()</code> function. |
| file         | The Python script to be executed.   |
| prepend_path | Boolean; should the script directory be added to the Python module search path? The default, TRUE, matches the behavior of python <code>&lt;path/to/script.py&gt;</code> at the command line. |

**Value**

A Python dictionary of objects. When `local` is `FALSE`, this dictionary captures the state of the Python main module after running the provided code. Otherwise, only the variables defined and used are captured.

---

|                |                                     |
|----------------|-------------------------------------|
| py_save_object | <i>Save and Load Python Objects</i> |
|----------------|-------------------------------------|

---

**Description**

Save and load Python objects.

**Usage**

```
py_save_object(object, filename, pickle = "pickle", ...)
```

```
py_load_object(filename, pickle = "pickle", ..., convert = TRUE)
```

**Arguments**

|          |  |
|----------|--|
| object   | A Python object.   |
| filename | The output file name. Note that the file extension <code>.pickle</code> is considered the "standard" extension for serialized Python objects as created by the <code>pickle</code> module. |
| pickle   | The "pickle" implementation to use. Defaults to "pickle", but other compatible Python "pickle" implementations (e.g. "cPickle") could be used as well.                                     |
| ...      | Optional arguments, to be passed to the <code>pickle</code> module's <code>dump()</code> and <code>load()</code> functions.  |
| convert  | Bool. Whether the loaded pickle object should be converted to an R object.   |

**Details**

Python objects are serialized using the `pickle` module – see <https://docs.python.org/3/library/pickle.html> for more details.

---

|             |  |
|-------------|--|
| py_set_attr | <i>Set an attribute of a Python object</i> |
|-------------|--|

---

**Description**

Set an attribute of a Python object

**Usage**

```
py_set_attr(x, name, value)
```

**Arguments**

|       |                 |
|-------|-----------------|
| x     | Python object   |
| name  | Attribute name  |
| value | Attribute value |

---

|             |  |
|-------------|--|
| py_set_seed | <i>Set Python and NumPy random seeds</i> |
|-------------|--|

---

**Description**

Set various random seeds required to ensure reproducible results. The provided seed value will establish a new random seed for Python and NumPy, and will also (by default) disable hash randomization.

**Usage**

```
py_set_seed(seed, disable_hash_randomization = TRUE)
```

**Arguments**

|                            |   |
|----------------------------|---|
| seed                       | A single value, interpreted as an integer   |
| disable_hash_randomization | Disable hash randomization, which is another common source of variable results. See <a href="https://docs.python.org/3/using/cmdline.html#envvar-PYTHONHASHSEED">https://docs.python.org/3/using/cmdline.html#envvar-PYTHONHASHSEED</a> |

**Details**

This function does not set the R random seed, for that you should call `set.seed()`.

---

py\_suppress\_warnings    *Suppress Python warnings for an expression*

---

**Description**

Suppress Python warnings for an expression

**Usage**

```
py_suppress_warnings(expr)
```

**Arguments**

expr                    Expression to suppress warnings for

**Value**

Result of evaluating expression

---

py\_unicode                *Convert to Python Unicode Object*

---

**Description**

Convert to Python Unicode Object

**Usage**

```
py_unicode(str)
```

**Arguments**

str                      Single element character vector to convert

**Details**

By default R character vectors are converted to Python strings. In Python 3 these values are unicode objects however in Python 2 they are 8-bit string objects. This function enables you to obtain a Python unicode object from an R character vector when running under Python 2 (under Python 3 a standard Python string object is returned).

---

|            |                       |
|------------|-----------------------|
| py_version | <i>Python version</i> |
|------------|-----------------------|

---

**Description**

Get the version of Python currently being used by reticulate.

**Usage**

```
py_version()
```

**Value**

The version of Python currently used, or NULL if Python has not yet been initialized by reticulate.

---

|                 |   |
|-----------------|---|
| r-py-conversion | <i>Convert between Python and R objects</i> |
|-----------------|---|

---

**Description**

Convert between Python and R objects

**Usage**

```
r_to_py(x, convert = FALSE)
```

```
py_to_r(x)
```

**Arguments**

|         |  |
|---------|--|
| x       | A Python object.   |
| convert | Boolean; should Python objects be automatically converted to their R equivalent? If set to FALSE, you can still manually convert Python objects to R via the <a href="#">py_to_r()</a> function. |

**Value**

An R object, as converted from the Python object.

repl\_python

*Run a Python REPL***Description**

This function provides a Python REPL in the R session, which can be used to interactively run Python code. All code executed within the REPL is run within the Python main module, and any generated Python objects will persist in the Python session after the REPL is detached.

**Usage**

```
repl_python(
  module = NULL,
  quiet = getOption("reticulate.repl.quiet", default = FALSE),
  input = NULL
)
```

**Arguments**

|        |  |
|--------|--|
| module | An (optional) Python module to be imported before the REPL is launched.  |
| quiet  | Boolean; print a startup banner when launching the REPL? If TRUE, the banner will be suppressed.                           |
| input  | Python code to be run within the REPL. Setting this can be useful if you'd like to drive the Python REPL programmatically. |

**Details**

When working with R and Python scripts interactively, one can activate the Python REPL with `repl_python()`, run Python code, and later run `exit` to return to the R console.

**Magics**

A handful of magics are supported in `repl_python()`:

Lines prefixed with `!` are executed as system commands:

- `!cmd --arg1 --arg2`: Execute arbitrary system commands

Magics start with a `%` prefix. Supported magics include:

- `%conda ...` executes a conda command in the active conda environment
- `%pip ...` executes `pip` for the active python.
- `%load, %loadpy, %run` executes a python file.
- `%system, !!` executes a system command and capture output
- `%env`: read current environment variables.
  - `%env name`: read environment variable 'name'.
  - `%env name=val, %env name val`: set environment variable 'name' to 'val'. `val` elements in `{}` are interpolated using f-strings (required Python  $\geq 3.6$ ).

- %cd <dir> change working directory.
  - %cd -: change to previous working directory (as set by %cd).
  - %cd -3: change to 3rd most recent working directory (as set by %cd).
  - %cd -foo/bar: change to most recent working directory matching "foo/bar" regex (in history of directories set via %cd).
- %pwd: print current working directory.
- %dhist: print working directory history.

Additionally, the output of system commands can be captured in a variable, e.g.:

- x = !ls

where x will be a list of strings, consisting of stdout output split in "\n" (stderr is not captured).

### Example

```
# enter the Python REPL, create a dictionary, and exit
repl_python()
dictionary = {'alpha': 1, 'beta': 2}
exit

# access the created dictionary from R
py$dictionary
# $alpha
# [1] 1
#
# $beta
# [1] 2
```

### See Also

[py](#), for accessing objects created using the Python REPL.

---

source\_python

*Read and evaluate a Python script*

---

### Description

Evaluate a Python script within the Python main module, then make all public (non-module) objects within the main Python module available within the specified R environment.

### Usage

```
source_python(file, envir = parent.frame(), convert = TRUE)
```

**Arguments**

|                      |   |
|----------------------|---|
| <code>file</code>    | The Python script to be executed.   |
| <code>envir</code>   | The environment to assign Python objects into (for example, <code>parent.frame()</code> or <code>globalenv()</code> ). Specify <code>NULL</code> to not assign Python objects.                              |
| <code>convert</code> | Boolean; should Python objects be automatically converted to their R equivalent? If set to <code>FALSE</code> , you can still manually convert Python objects to R via the <code>py_to_r()</code> function. |

**Details**

To prevent assignment of objects into R, pass `NULL` for the `envir` parameter.

---

|                    |                            |
|--------------------|----------------------------|
| <code>tuple</code> | <i>Create Python tuple</i> |
|--------------------|----------------------------|

---

**Description**

Create a Python tuple object

**Usage**

```
tuple(..., convert = FALSE)
```

**Arguments**

|                      |  |
|----------------------|--|
| <code>...</code>     | Values for tuple (or a single list to be converted to a tuple).  |
| <code>convert</code> | TRUE to automatically convert Python objects to their R equivalent. If you pass <code>FALSE</code> you can do manual conversion using the <code>py_to_r()</code> function. |

**Value**

A Python tuple

**Note**

The returned tuple will not automatically convert its elements from Python to R. You can do manual conversion with the `py_to_r()` function or pass `convert = TRUE` to request automatic conversion.



---

`use_python`*Use Python*

---

### Description

Select the version of Python to be used by reticulate.

### Usage

```
use_python(python, required = NULL)
```

```
use_python_version(version, required = NULL)
```

```
use_virtualenv(virtualenv = NULL, required = NULL)
```

```
use_condaenv(condaenv = NULL, conda = "auto", required = NULL)
```

```
use_miniconda(condaenv = NULL, required = NULL)
```

### Arguments

|                         |  |
|-------------------------|--|
| <code>python</code>     | The path to a Python binary.   |
| <code>required</code>   | Is the requested copy of Python required? If TRUE, an error will be emitted if the requested copy of Python does not exist. If FALSE, the request is taken as a hint only, and scanning for other versions will still proceed. A value of NULL (the default), is equivalent to TRUE.   |
| <code>version</code>    | The version of Python to use. <code>reticulate</code> will search for versions of Python as installed by the <code>install_python()</code> helper function.  |
| <code>virtualenv</code> | Either the name of, or the path to, a Python virtual environment.  |
| <code>condaenv</code>   | The conda environment to use. For <code>use_condaenv()</code> , this can be the name, the absolute prefix path, or the absolute path to the python binary. If the name is ambiguous, the first environment is used and a warning is issued. For <code>use_miniconda()</code> , the only conda installation searched is the one installed by <code>install_miniconda()</code> . |
| <code>conda</code>      | The path to a conda executable. By default, <code>reticulate</code> will check the PATH, as well as other standard locations for Anaconda installations.   |

### Details

The `reticulate` package initializes its Python bindings lazily – that is, it does not initialize its Python bindings until an API that explicitly requires Python to be loaded is called. This allows users and package authors to request particular versions of Python by calling `use_python()` or one of the other helper functions documented in this help file.

## RETICULATE\_PYTHON

The RETICULATE\_PYTHON environment variable can also be used to control which copy of Python reticulate chooses to bind to. It should be set to the path to a Python interpreter, and that interpreter can either be:

- A standalone system interpreter,
- Part of a virtual environment,
- Part of a Conda environment.

When set, this will override any other requests to use a particular copy of Python. Setting this in `~/.Renviro`n (or optionally, a project `.Renviro`n) can be a useful way of forcing reticulate to use a particular version of Python.

### Caveats

Note that the requests for a particular version of Python via `use_python()` and friends only persist for the active session; they must be re-run in each new R session as appropriate.

If `use_python()` (or one of the other `use_*`() functions) are called multiple times, the most recently-requested version of Python will be used. Note that any request to `use_python()` will always be overridden by the RETICULATE\_PYTHON environment variable, if set.

The `py_config()` function will also provide a short note describing why reticulate chose to select the version of Python that was ultimately activated.

---

virtualenv-tools

*Interface to Python Virtual Environments*

---

### Description

R functions for managing Python **virtual environments**.

### Usage

```
virtualenv_create(
  envname = NULL,
  python = virtualenv_starter(version),
  ...,
  version = NULL,
  packages = "numpy",
  requirements = NULL,
  force = FALSE,
  module = getOption("reticulate.virtualenv.module"),
  system_site_packages = getOption("reticulate.virtualenv.system_site_packages", default = FALSE),
  pip_version = getOption("reticulate.virtualenv.pip_version", default = NULL),
  setuptools_version = getOption("reticulate.virtualenv.setuptools_version", default = NULL),
)
```

```

    extra = getOption("reticulate.virtualenv.extra", default = NULL)
  )

virtualenv_install(
  envname = NULL,
  packages = NULL,
  ignore_installed = FALSE,
  pip_options = character(),
  requirements = NULL,
  ...,
  python_version = NULL
)

virtualenv_remove(envname = NULL, packages = NULL, confirm = interactive())

virtualenv_list()

virtualenv_root()

virtualenv_python(envname = NULL)

virtualenv_exists(envname = NULL)

virtualenv_starter(version = NULL, all = FALSE)

```

### Arguments

|                         |   |
|-------------------------|---|
| envname                 | The name of, or path to, a Python virtual environment. If this name contains any slashes, the name will be interpreted as a path; if the name does not contain slashes, it will be treated as a virtual environment within <code>virtualenv_root()</code> . When NULL, the virtual environment as specified by the <code>RETICULATE_PYTHON_ENV</code> environment variable will be used instead. To refer to a virtual environment in the current working directory, you can prefix the path with <code>./&lt;name&gt;</code> . |
| python                  | The path to a Python interpreter, to be used with the created virtual environment. This can also accept a version constraint like "3.10", which is passed on to <code>virtualenv_starter()</code> to find a suitable python binary.   |
| ...                     | Optional arguments; currently ignored and reserved for future expansion.  |
| version, python_version | (string) The version of Python to use when creating a virtual environment. Python installations will be searched for using <code>virtualenv_starter()</code> . This can a specific version, like "3.9" or "3.9.3", or a comma separated list of version constraints, like " <code>&gt;=3.8</code> ", or " <code>&lt;=3.11,!3.9.3,&gt;3.6</code> "   |
| packages                | A set of Python packages to install (via <code>pip install</code> ) into the virtual environment, after it has been created. By default, the "numpy" package will be installed, and the pip, setuptools and wheel packages will be updated. Set this to FALSE to avoid installing any packages after the virtual environment has been created.  |
| requirements            | Filepath to a pip requirements file.  |

|                                   |   |
|-----------------------------------|---|
| <code>force</code>                | Boolean; force recreating the environment specified by <code>envname</code> , even if it already exists. If <code>TRUE</code> , the pre-existing environment is first deleted and then recreated. Otherwise, if <code>FALSE</code> (the default), the path to the existing environment is returned.   |
| <code>module</code>               | The Python module to be used when creating the virtual environment – typically, <code>virtualenv</code> or <code>venv</code> . When <code>NULL</code> (the default), <code>venv</code> will be used if available with Python $\geq 3.6$ ; otherwise, the <code>virtualenv</code> module will be used.   |
| <code>system_site_packages</code> | Boolean; create new virtual environments with the <code>--system-site-packages</code> flag, thereby allowing those virtual environments to access the system's site packages? Defaults to <code>FALSE</code> .  |
| <code>pip_version</code>          | The version of <code>pip</code> to be installed in the virtual environment. Relevant only when <code>module == "virtualenv"</code> . Set this to <code>FALSE</code> to disable installation of <code>pip</code> altogether.   |
| <code>setuptools_version</code>   | The version of <code>setuptools</code> to be installed in the virtual environment. Relevant only when <code>module == "virtualenv"</code> . Set this to <code>FALSE</code> to disable installation of <code>setuptools</code> altogether.   |
| <code>extra</code>                | An optional set of extra command line arguments to be passed. Arguments should be quoted via <code>shQuote()</code> when necessary.   |
| <code>ignore_installed</code>     | Boolean; ignore previously-installed versions of the requested packages? (This should normally be <code>TRUE</code> , so that pre-installed packages available in the site libraries are ignored and hence packages are installed into the virtual environment.)  |
| <code>pip_options</code>          | An optional character vector of additional command line arguments to be passed to <code>pip</code> .  |
| <code>confirm</code>              | Boolean; confirm before removing packages or virtual environments?  |
| <code>all</code>                  | If <code>TRUE</code> , <code>virtualenv_starter()</code> returns a 2-column data frame, with column names <code>path</code> and <code>version</code> . If <code>FALSE</code> , only a single path to a python binary is returned, corresponding to the first entry when <code>all = TRUE</code> , or <code>NULL</code> if no suitable python binaries were found. |

## Details

Virtual environments are by default located at `~/virtualenvs` (accessed with the `virtualenv_root()` function). You can change the default location by defining the `WORKON_HOME` environment variable.

Virtual environments are created from another "starter" or "seed" Python already installed on the system. Suitable Pythons installed on the system are found by `virtualenv_starter()`.

---

```
with.python.builtin.object
```

*Evaluate an expression within a context.*

---

### Description

The with method for objects of type python.builtin.object implements the context manager protocol used by the Python with statement. The passed object must implement the **context manager** (`__enter__` and `__exit__` methods).

### Usage

```
## S3 method for class 'python.builtin.object'  
with(data, expr, as = NULL, ...)
```

### Arguments

|      |   |
|------|---|
| data | Context to enter and exit   |
| expr | Expression to evaluate within the context   |
| as   | Name of variable to assign context to for the duration of the expression's evaluation (optional). |
| ...  | Unused  |

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