Tokyo.R #80

2019.07.27

R Interface to Python

kilometer00

Who！？

Who！？

名前： 三村 @kilometer

職業： ポスドク (こうがくはくし)

専門： 行動神経科学(霊長類)

脳イメージング

医療システム工学

R歴： ~ 10年ぐらい

流行: カメ

2018.07.15 Tokyo.R #71
Landscape with R – the Japanese R community

2018.10.20 Tokyo.R #73
BeginneR Session – Visualization & Plot

2019.01.19 Tokyo.R #75
BeginneR Session – Data pipeline

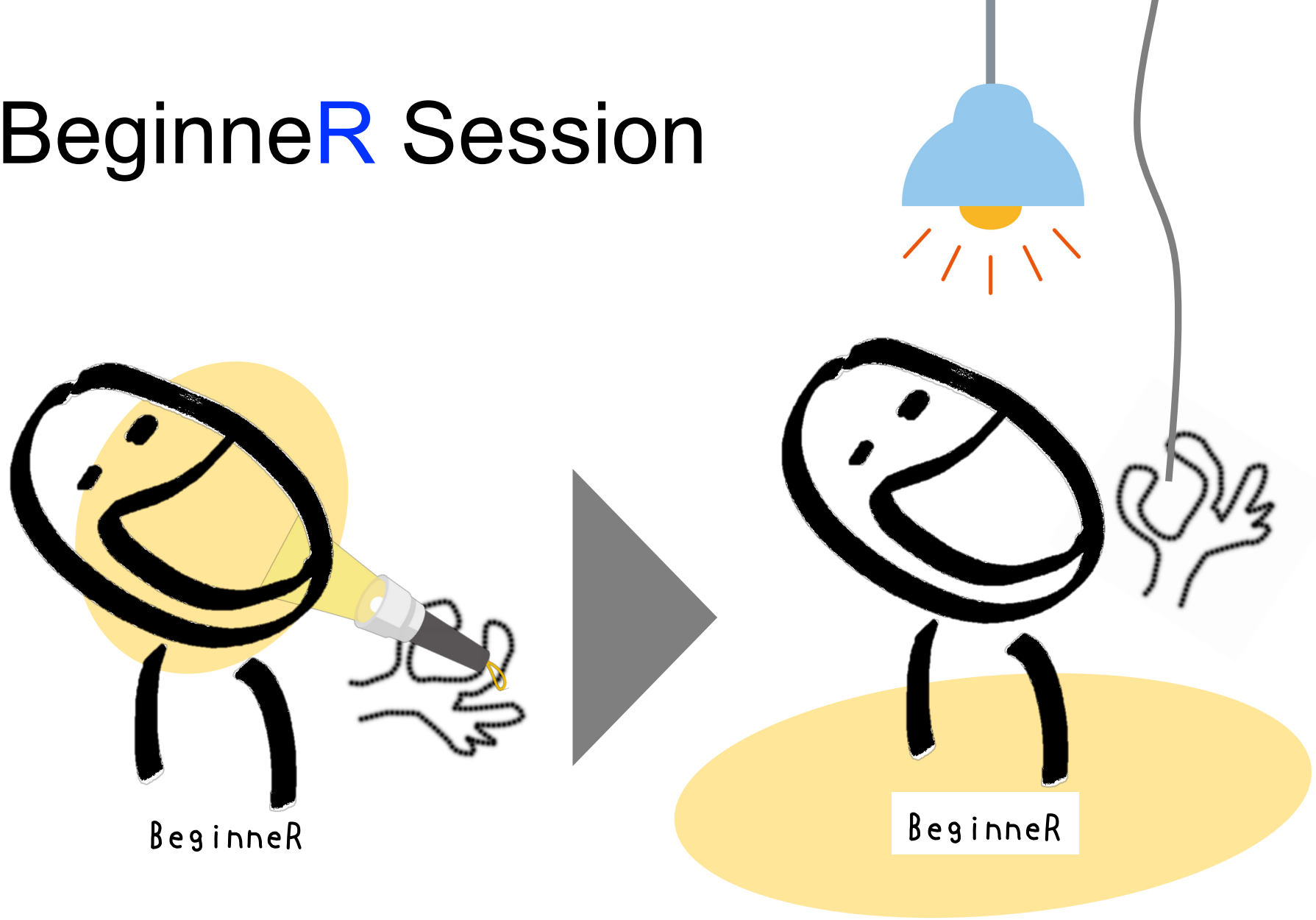
2019.03.02 Tokyo.R #76
BeginneR Session – Data pipeline

2019.04.13 Tokyo.R #77
BeginneR Session – Data analysis

2019.05.25 Tokyo.R #78
BeginneR Session – Data analysis

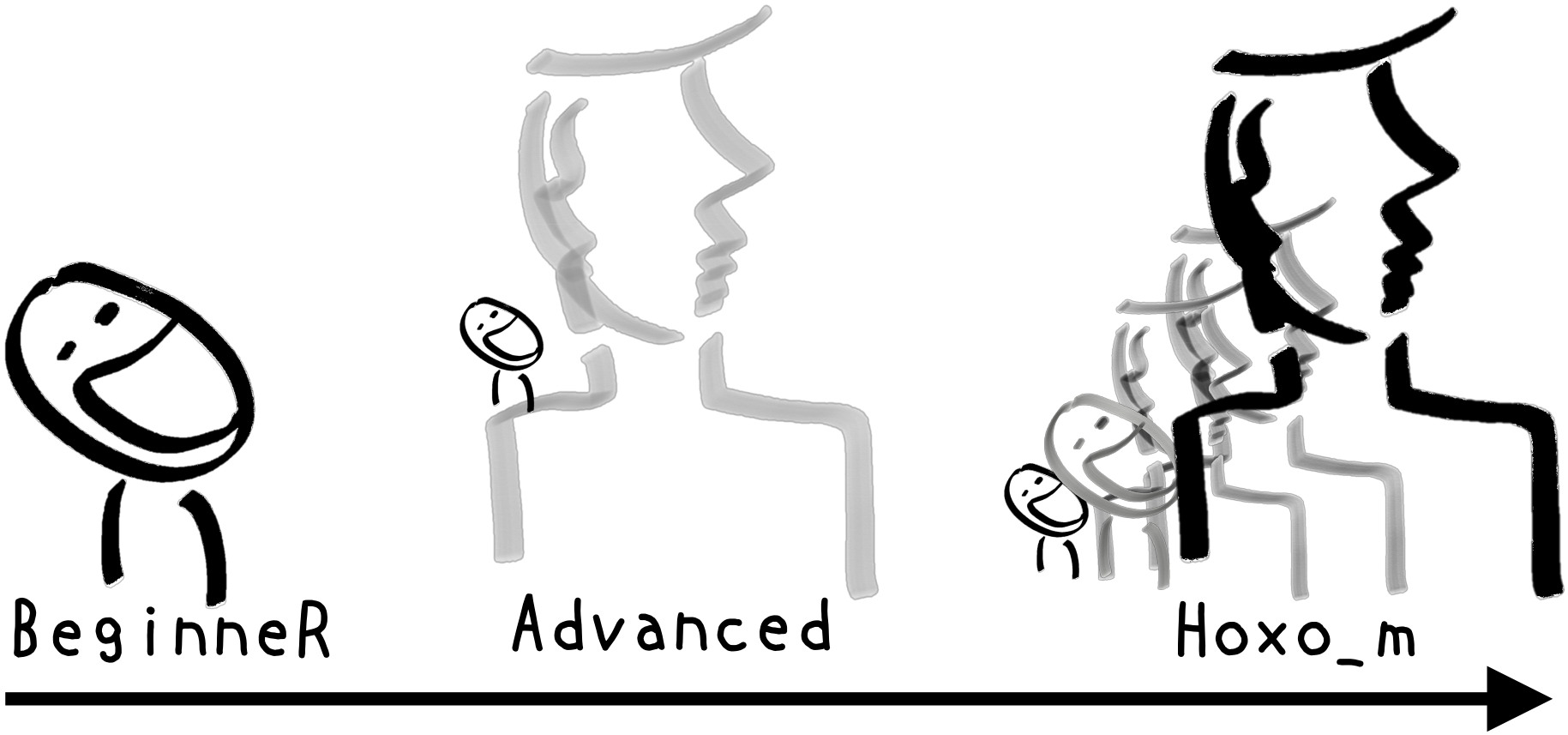
2019.06.29 Tokyo.R #79
BeginneR Session – 確率の基礎

BeginneR Session



Before

After



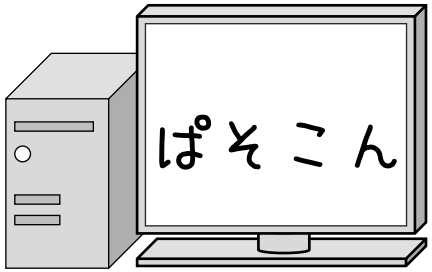
If I have seen further it is by standing on the shoulders of Giants.

-- Sir Isaac Newton, 1676

R Interface to Python

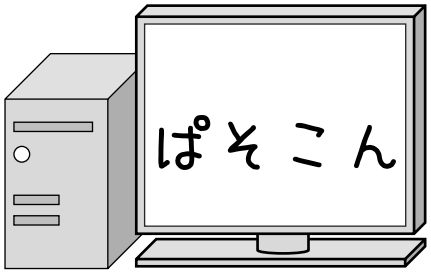
一昔前

私もそろそろ

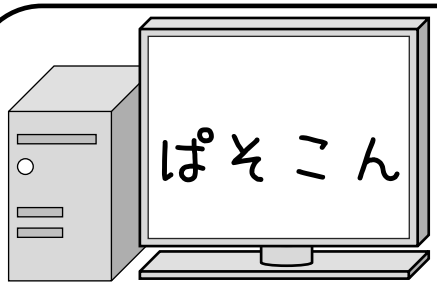


を、始めたいんだけど。

できるんでしょ？教えてよ。

いいけど、 

で何がしたいの？

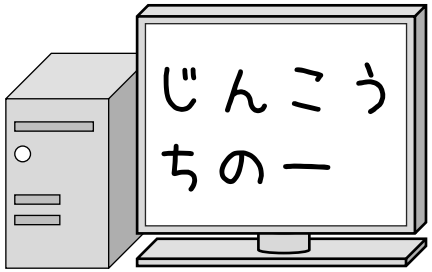


って何でもできるんでしょ？

でも、どうしたらいいか分かんないんだ。

最近

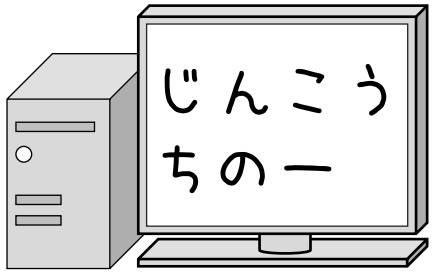
私もそろそろ



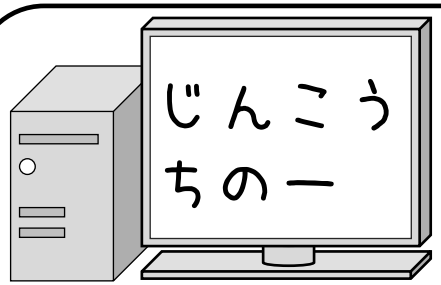
を、始めたいんだけど。

できるんでしょ？教えてよ。

いいけど、



で何がしたいの？



って何でもできるんでしょ？

でも、どうしたらいいか分かんないんだ。

私もそろそろ

を、始めたいんだけど。

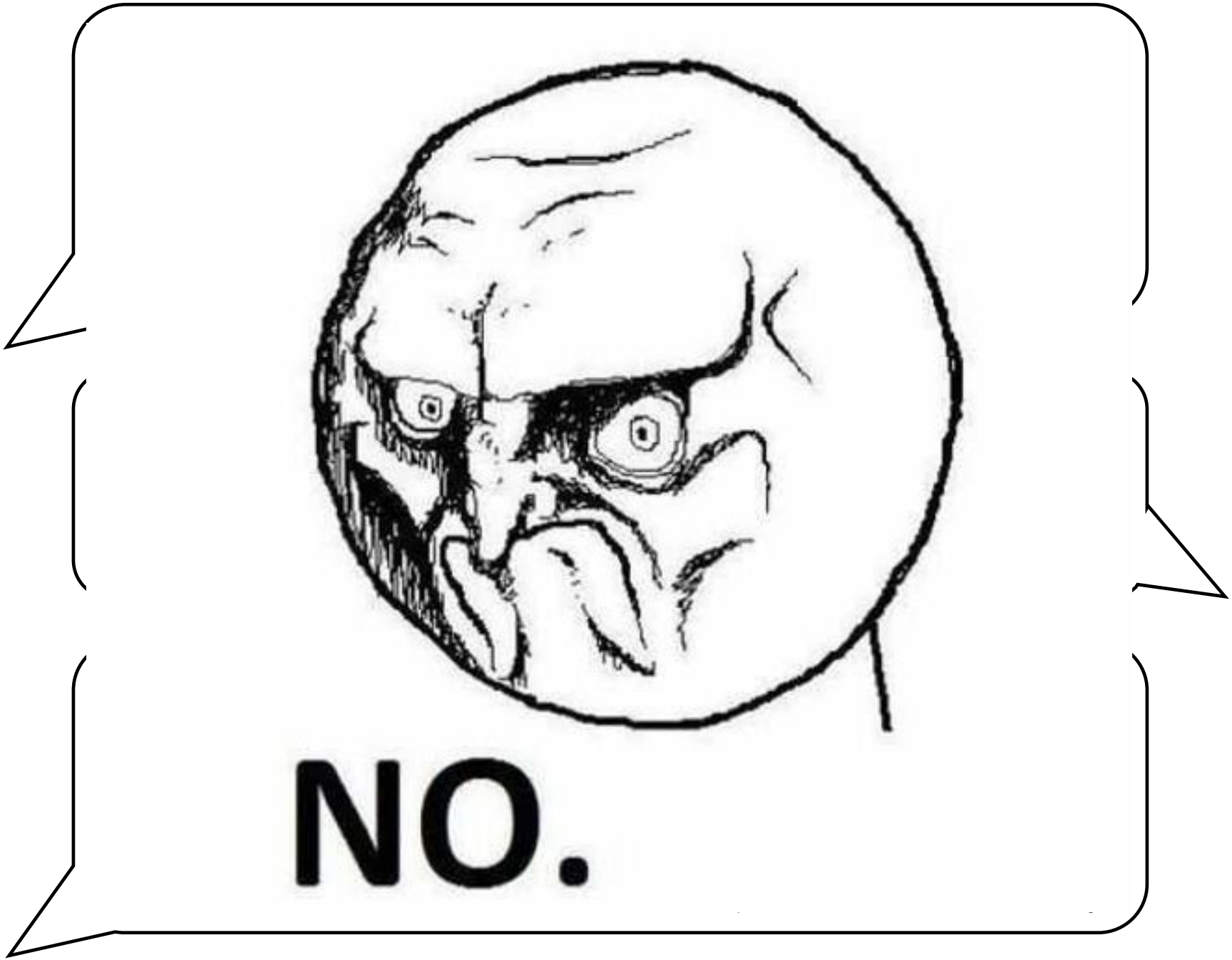
できるんでしょ？教えてよ。

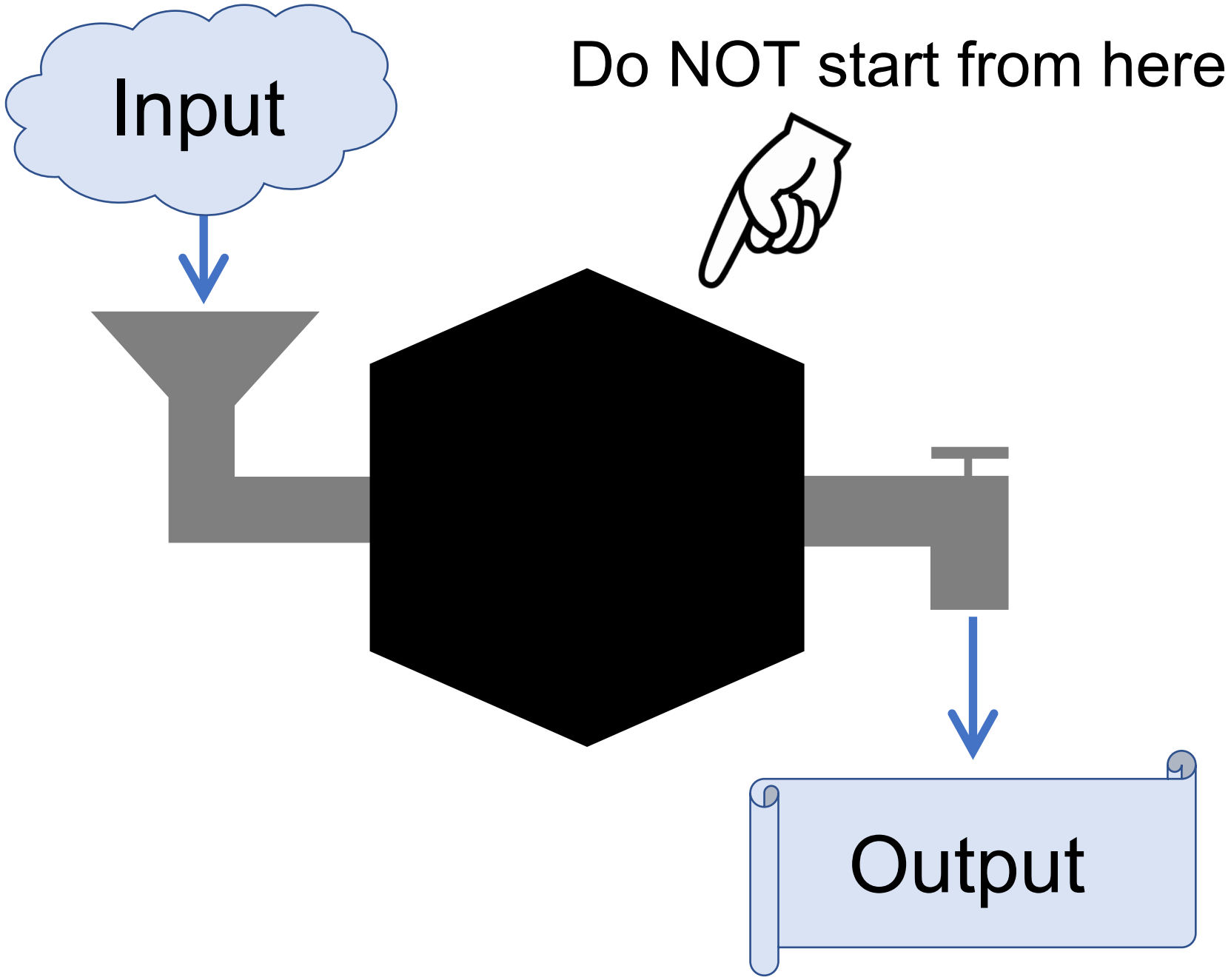
いいけど、

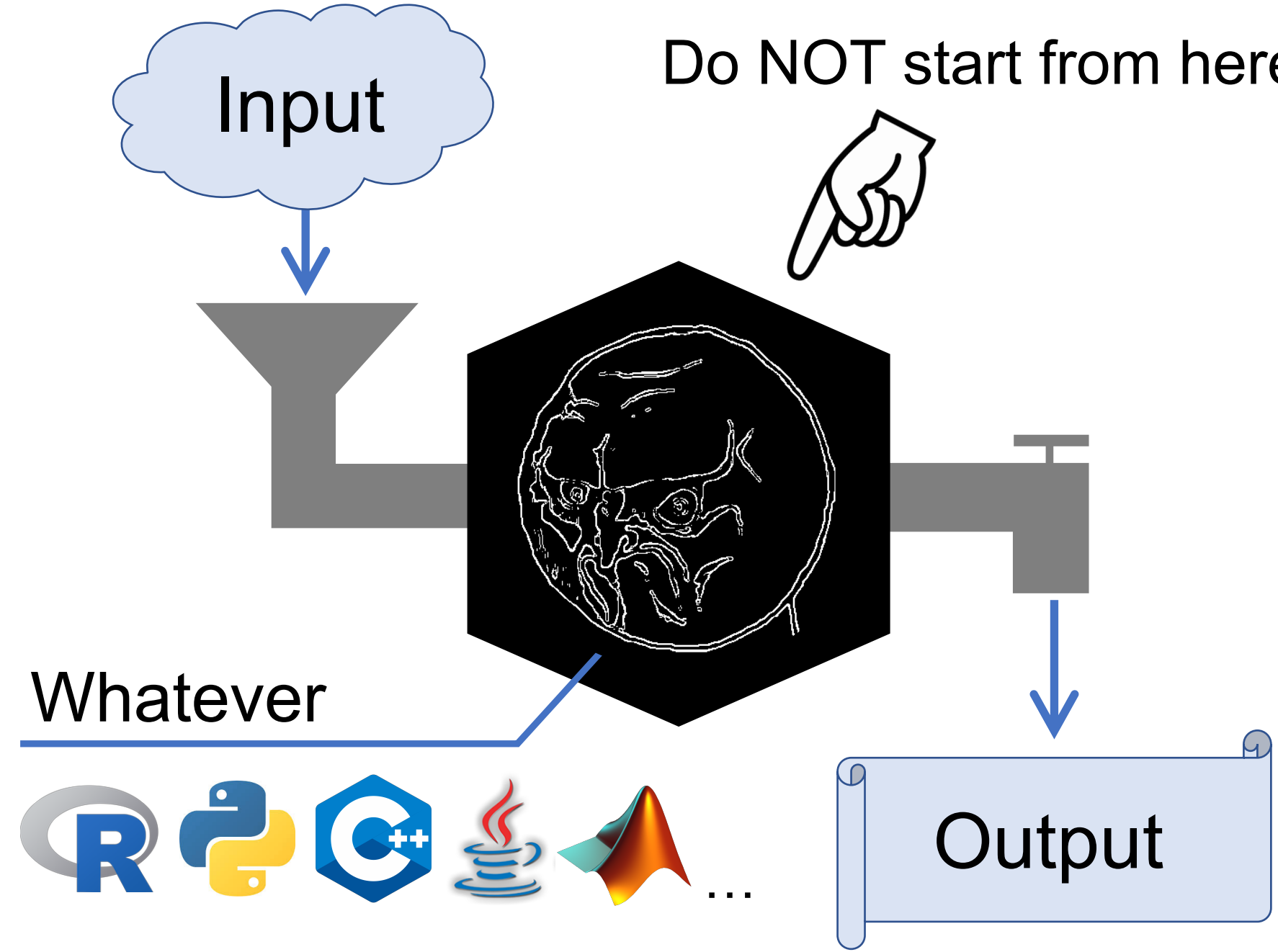
で何がしたいの？

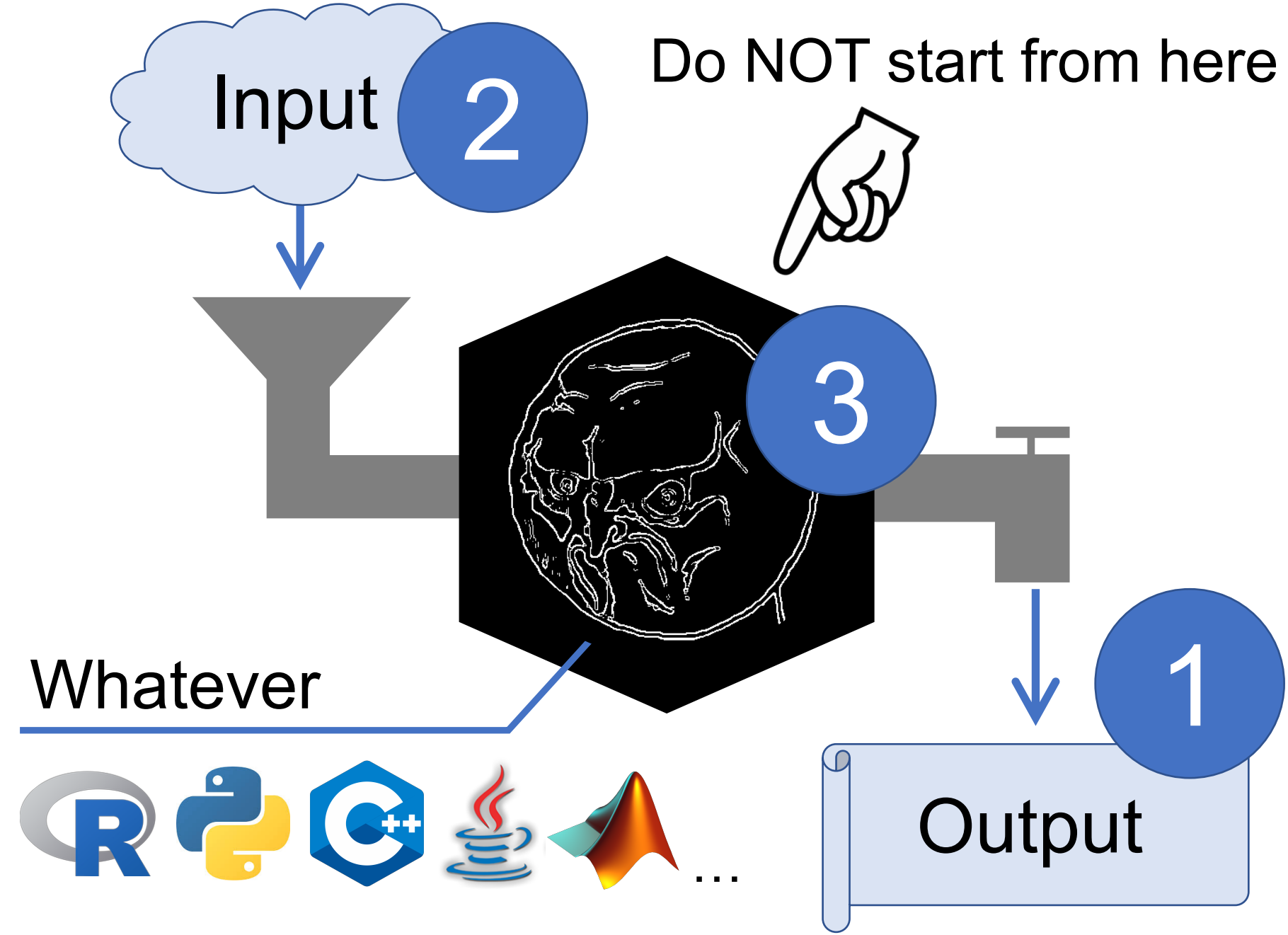
って何でもできるんでしょ？

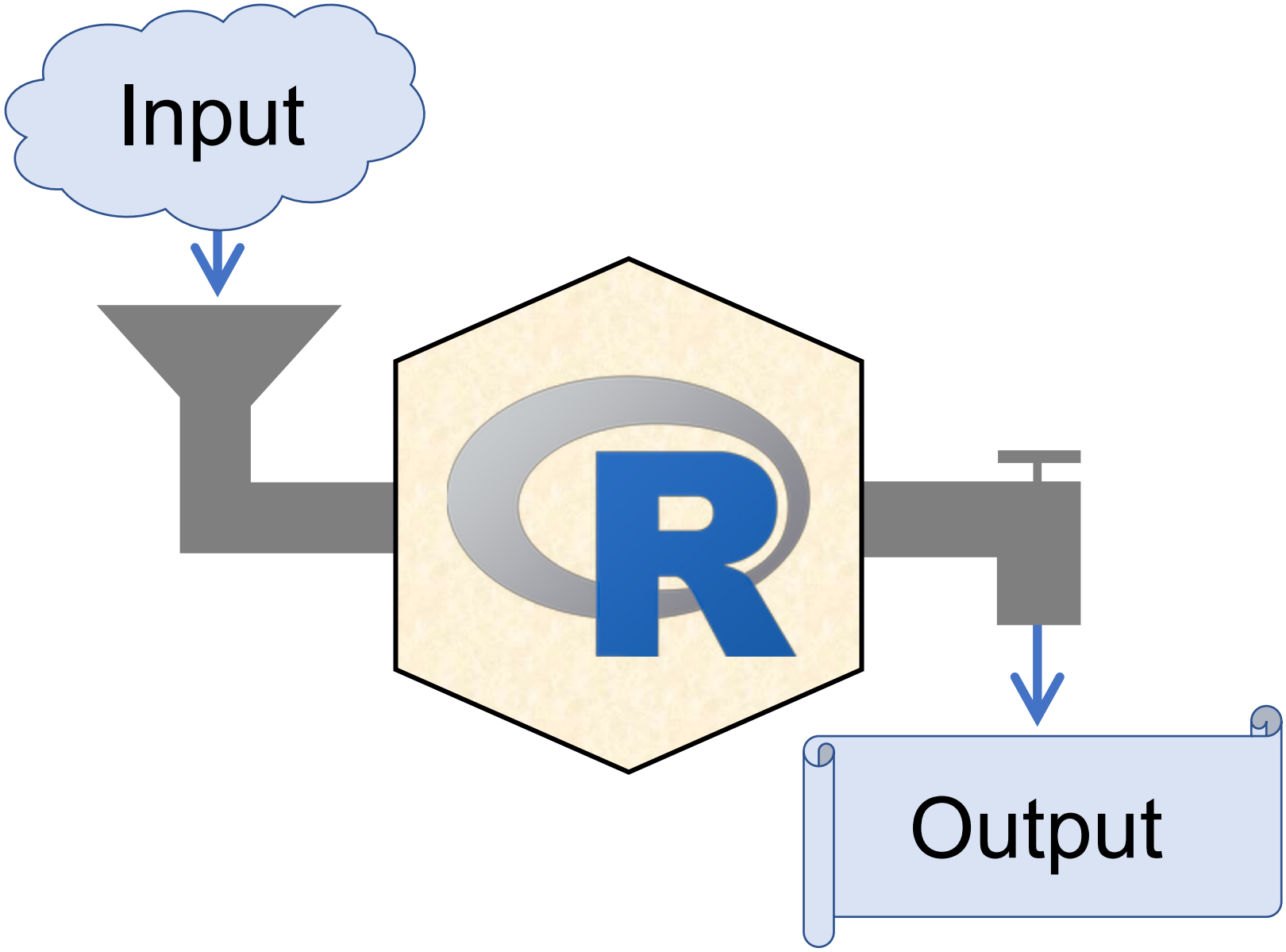
でも、どうしたらいいか分かんないんだ。


NO.


Input
Do NOT start from here
Output

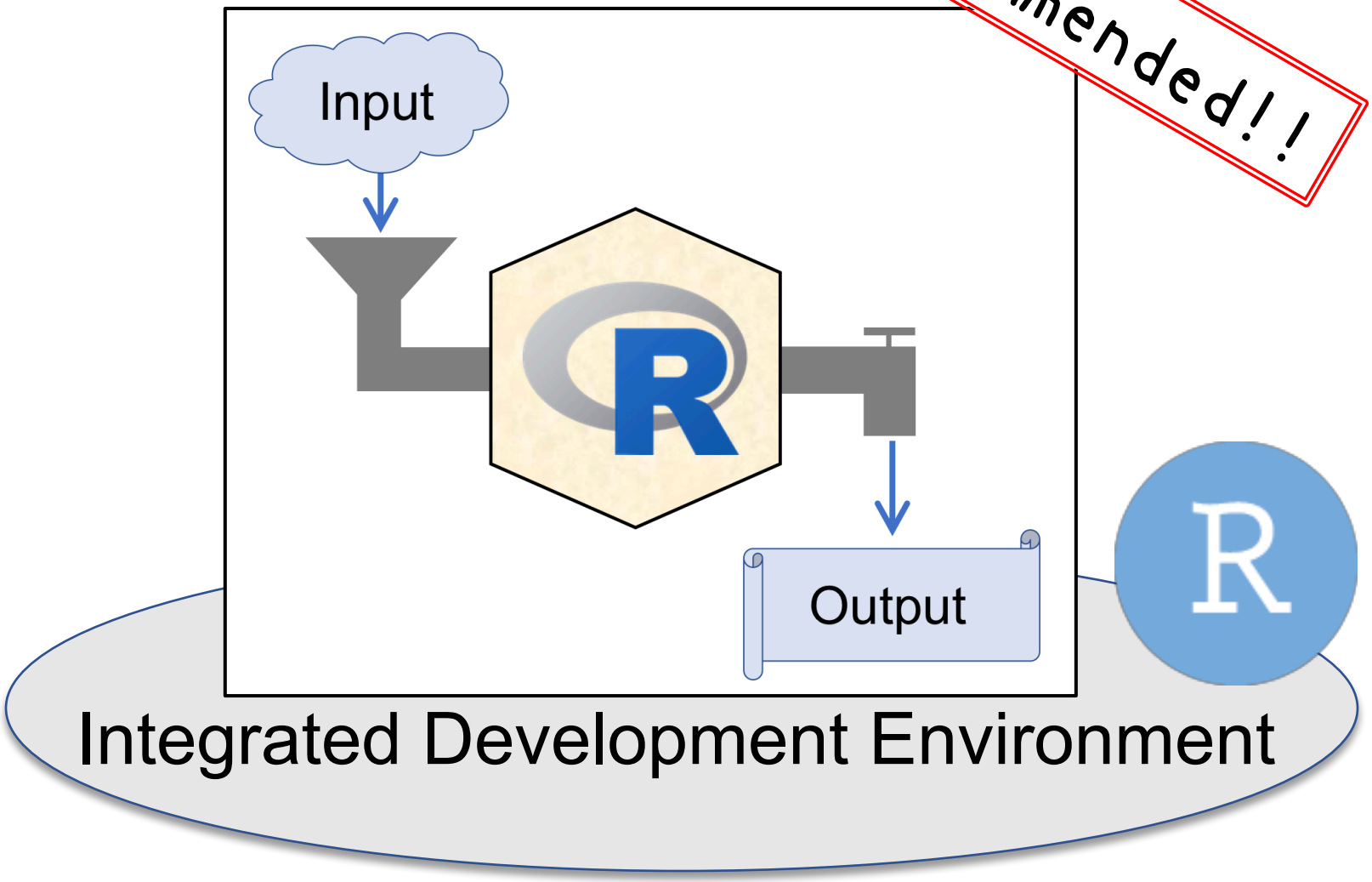

Input
Do NOT start from here
Whatever
...
Output


Input
2
Do NOT start from here
3
Whatever
1
Output
...

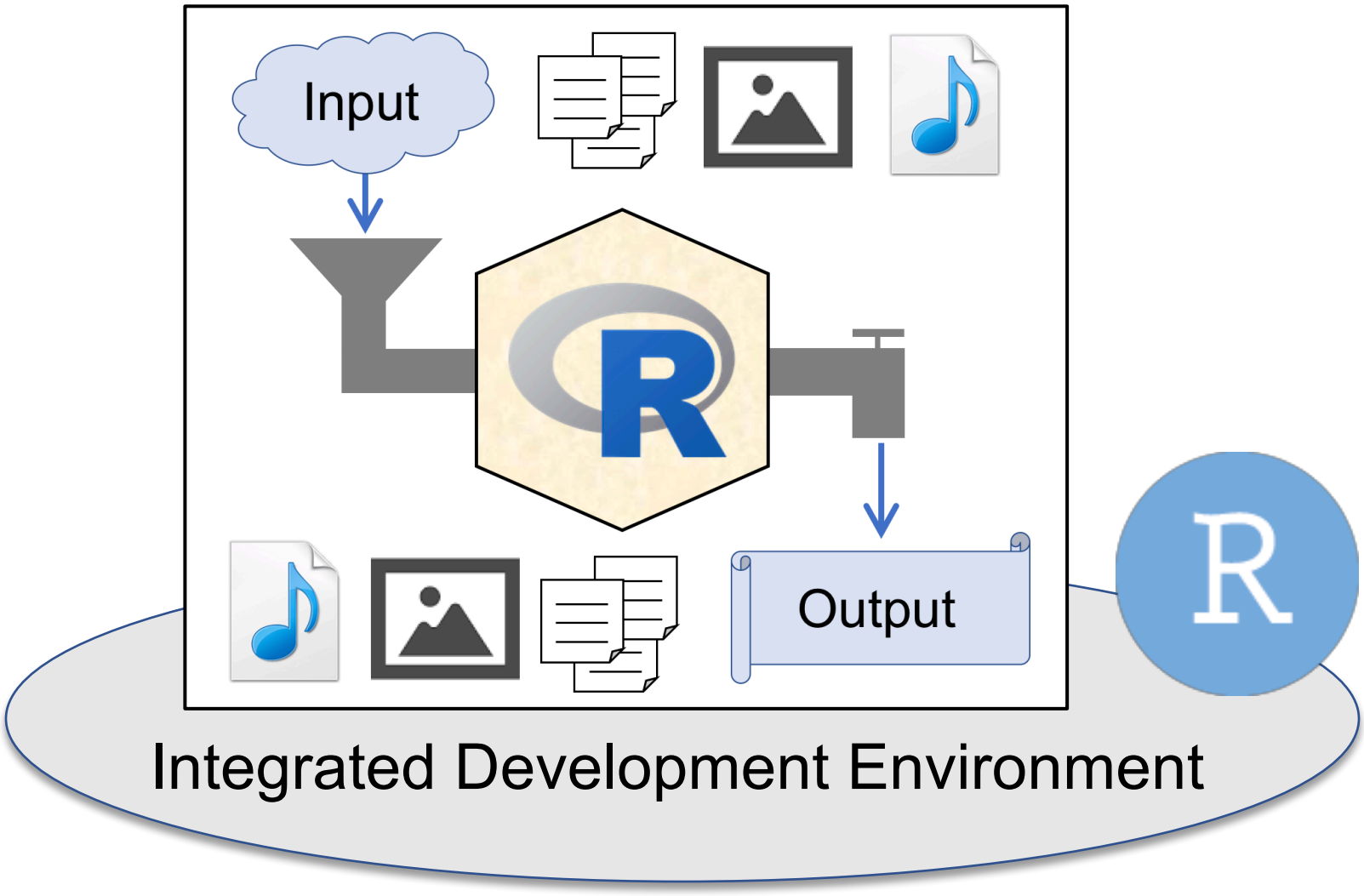

Input
R
Output

RStudio https://www.rstudio.com/

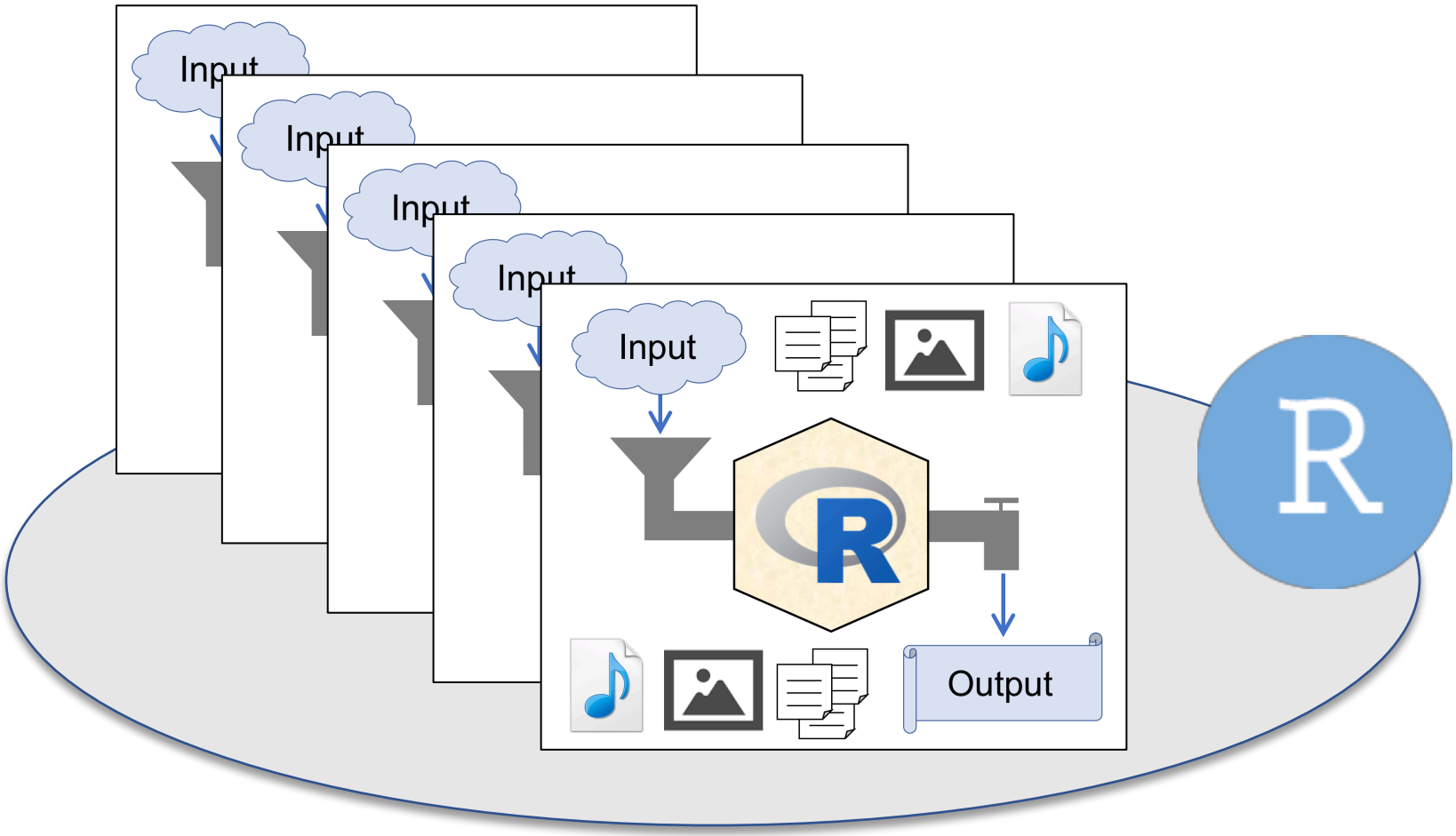
Recommended!!



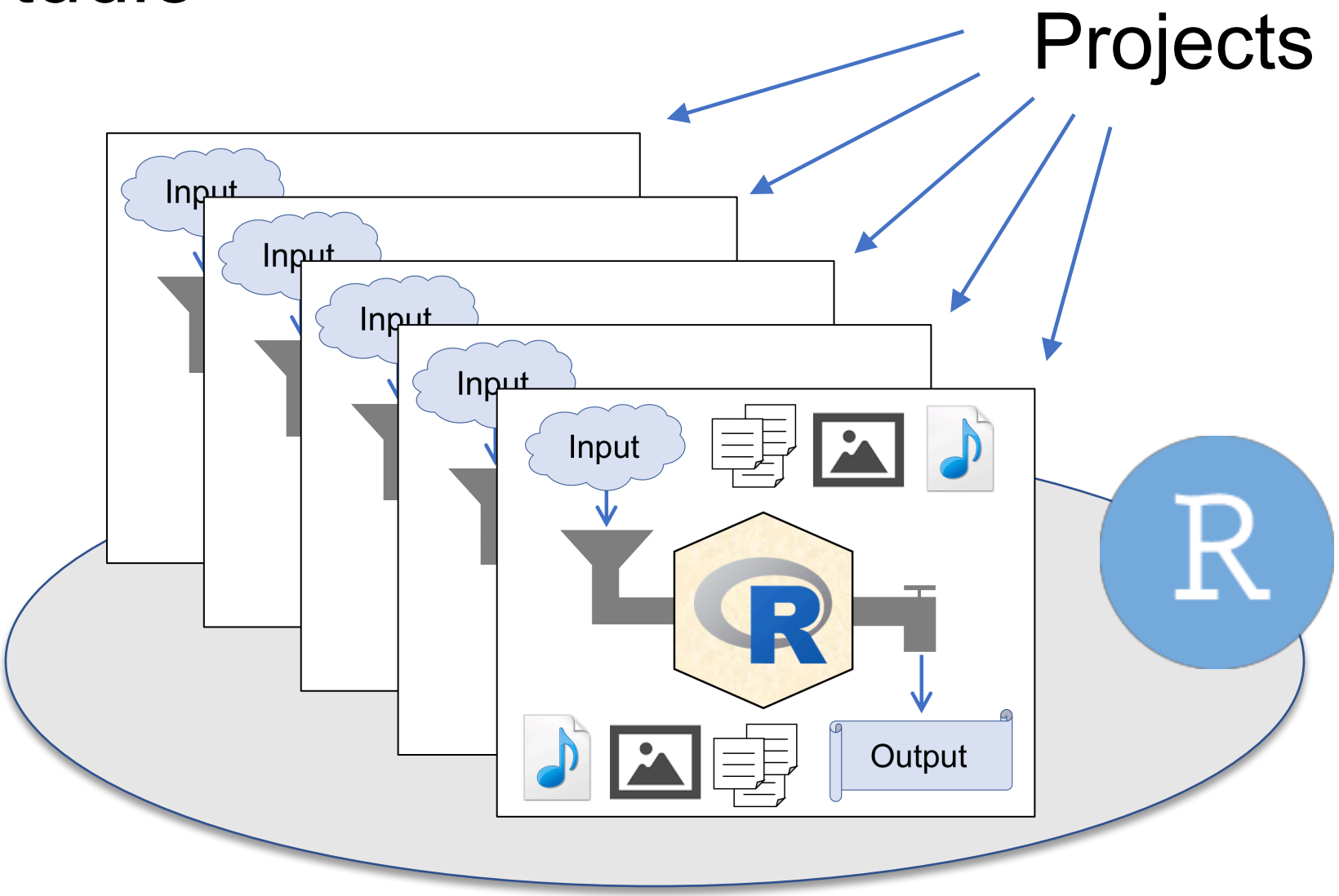
RStudio https://www.rstudio.com/



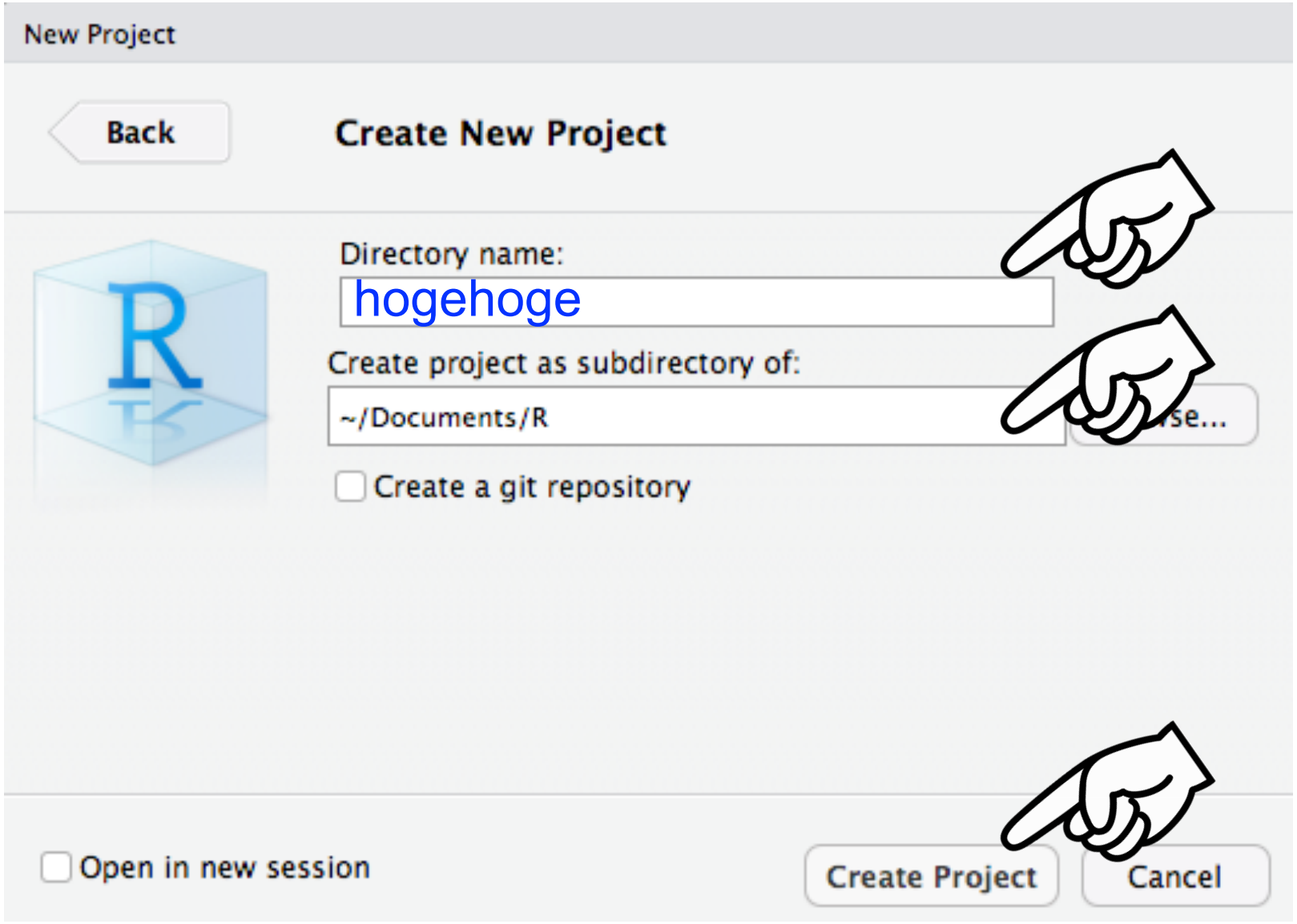
RStudio

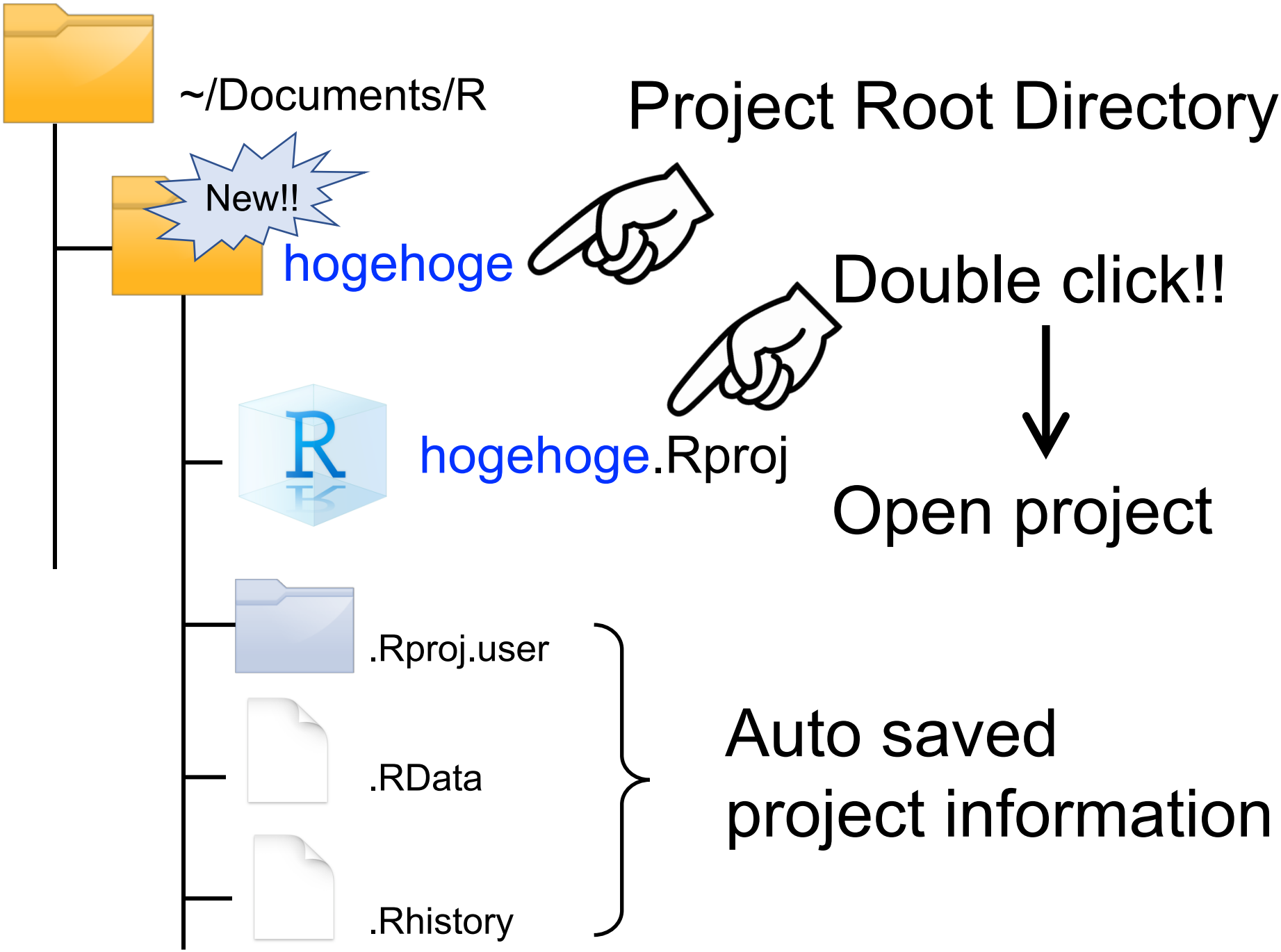


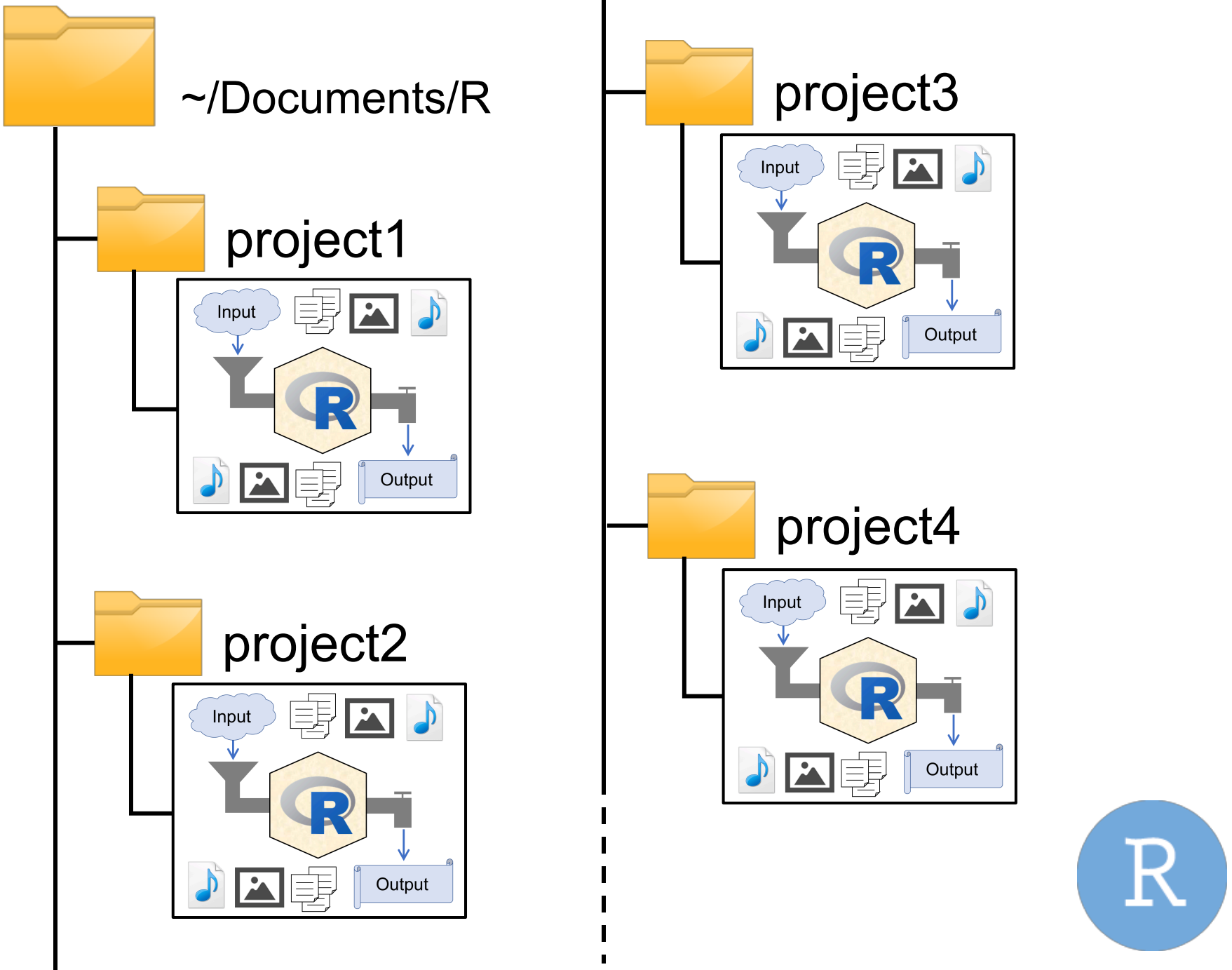
RStudio



File > New Project… > New Directory > New Project




~/Documents/R
Project Root Directory
New!!
hogehoge
Double click!!
hogehoge.Rproj
Open project
.Rproj.user
.RData
.Rhistory
Auto saved
project information


~/Documents/R
project1
Input
Output
project2
Input
Output
project3
Input
Output
project4
Input
Output


python
TM

Variable assignment & naming

○	var_1 <- 1
○	1 -> var_1
▼	var_1 = 1

○	var_1 = 1

×	1var <- 1
×	_var <- 1
○	.var <- 1
○	var.1 <- 1
▼	list <- 1

×	1var = 1
▼	_var = 1
×	.var = 1
▼	var.1 = 1
▼	list = 1

Variable type (basic)

Character

```
> typeof("1")
[1] "character"
```

String

```
>>> type("1")
<type 'str'>
```

Double

```
> typeof(1)
[1] "double"
```

```
> typeof(1.0)
[1] "double"
```

Float

```
>>> type(1.0)
<type 'float'>
```

Integer

```
> typeof(as.integer(1))
[1] "integer"
```

```
> typeof(1L)
[1] "integer"
```

Integer

```
>>> type(1)
<type 'int'>
```

Use packages

```
library(reticulate)
py_str(...)
```

or

```
reticulate::py_str(...)
```

```
imort numpy
numpy.array([1:3])
```

or

```
imort numpy as np
np.array([1:3])
```

or

```
from numpy import array
array([1:3])
```

Loop

```r
for(i in 1:10){
  i = i + 1
}
```

```r
for(i in 1:10){
i = i + 1
}
```

```r
for(i in 1:10) i = i + 1
```

```python
for i in range(10):
  i = i + 1
```

× INDENT ERROR

```python
for i in range(10):
i = i + 1
```

```python
for i in range(10):
  i += i
```

Function definition

```r
f <- function(val1, ...){
  ....
  return(...)
}
```

```python
def f(val1, ...):
    ....
    return(...)
```

CHECK YOUR INDENT

Import & Export csv

```r
dat <- read.csv(<path>)
write.csv(dat, <path>)
```

```python
import pandas as pd
dat = pd.read_csv(<path>)
dat.to_csv(<path>)
```


R

≈

reticulate package

URL: https://github.com/rstudio/reticulate

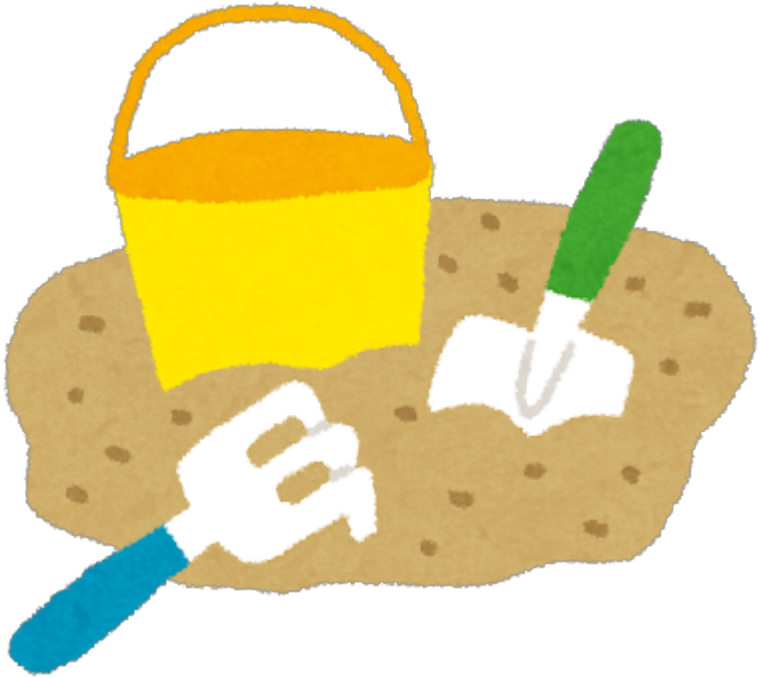
reticulate package

- Calling Python from R
  in a variety of ways including R Markdown,
  sourcing Python scripts,
  importing Python modules,
  and using Python interactively within an R session.
- Translation between R and Python objects
  (for example, between R and Pandas data frames,
  or between R matrices and NumPy arrays).

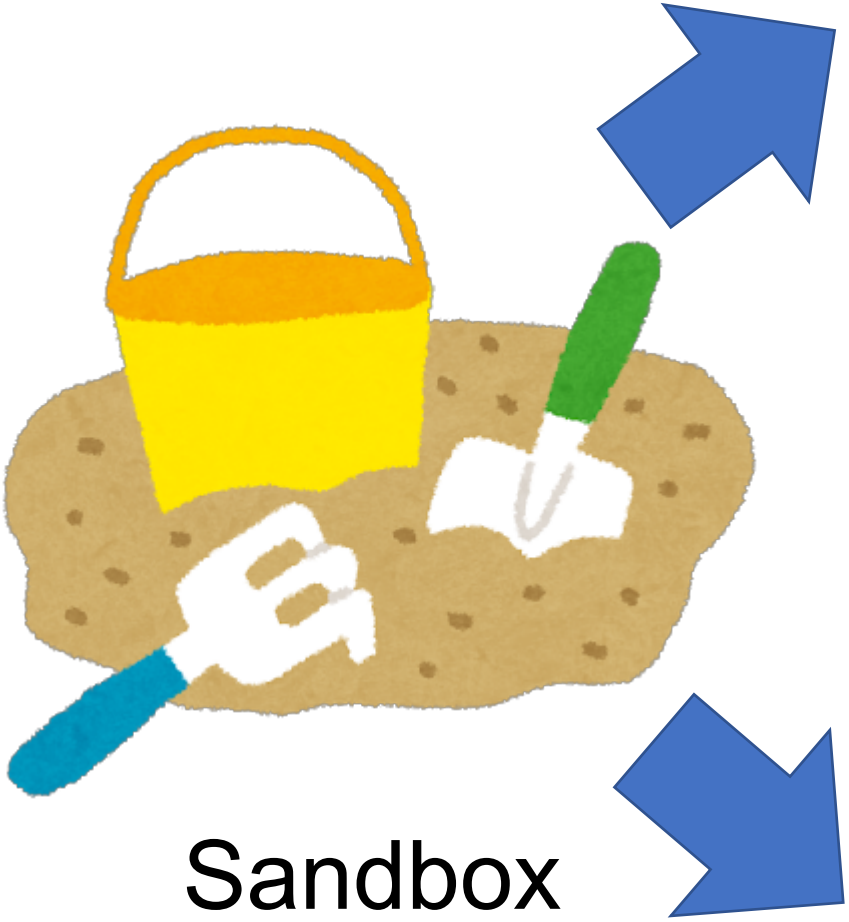
URL: https://github.com/rstudio/reticulate

Environment setup for Python

(in macOS Mojave 10.14.3)



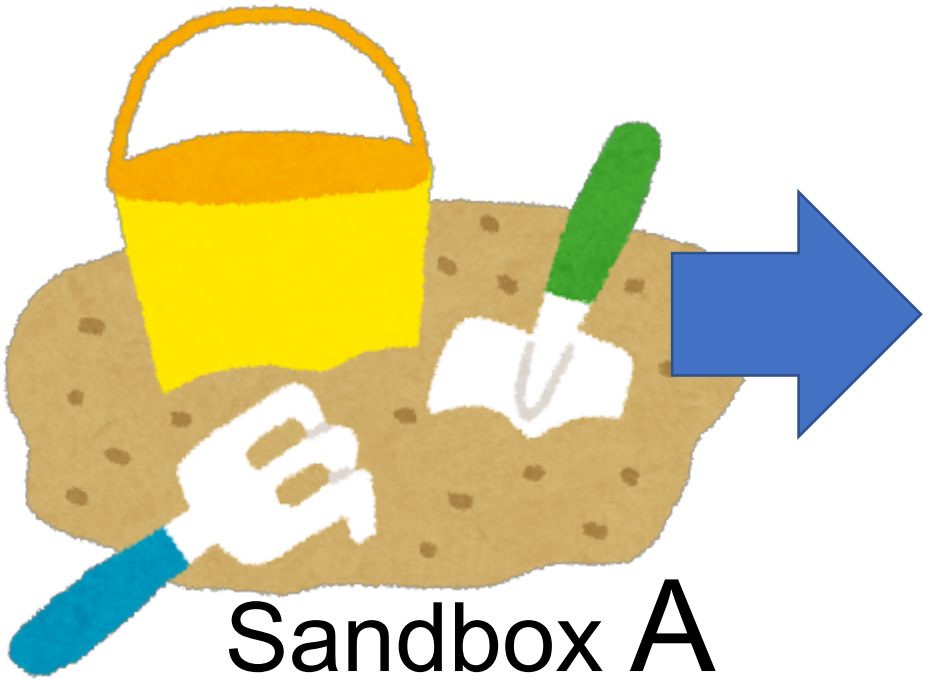
Sandbox



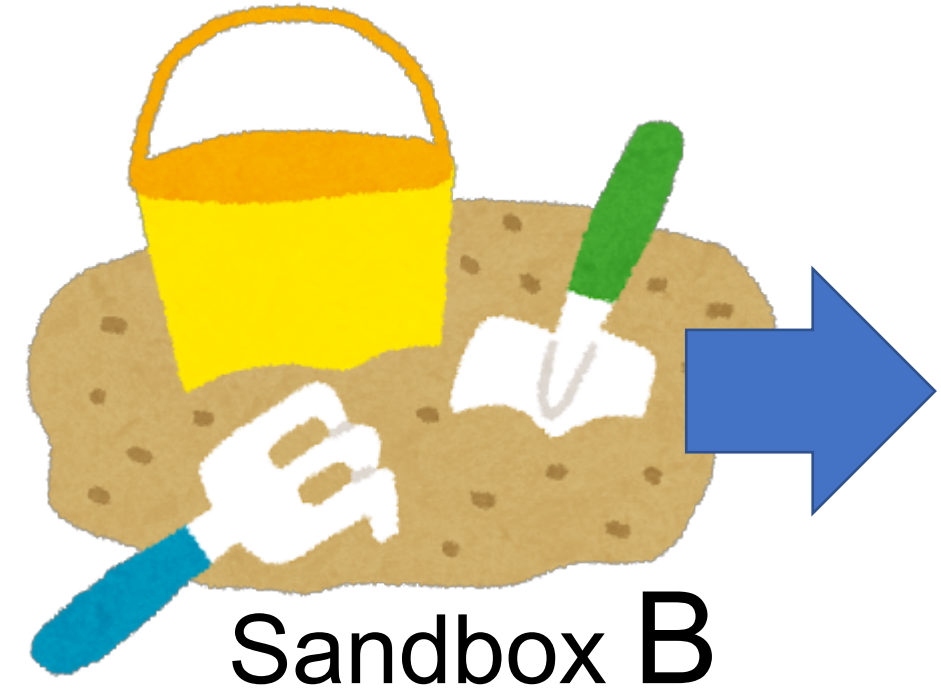
Sandbox


http://buzz-plus.com/2014/07/25/suna/
Guy-Olivier Deveau sculpture - godeveau@hotmail.com

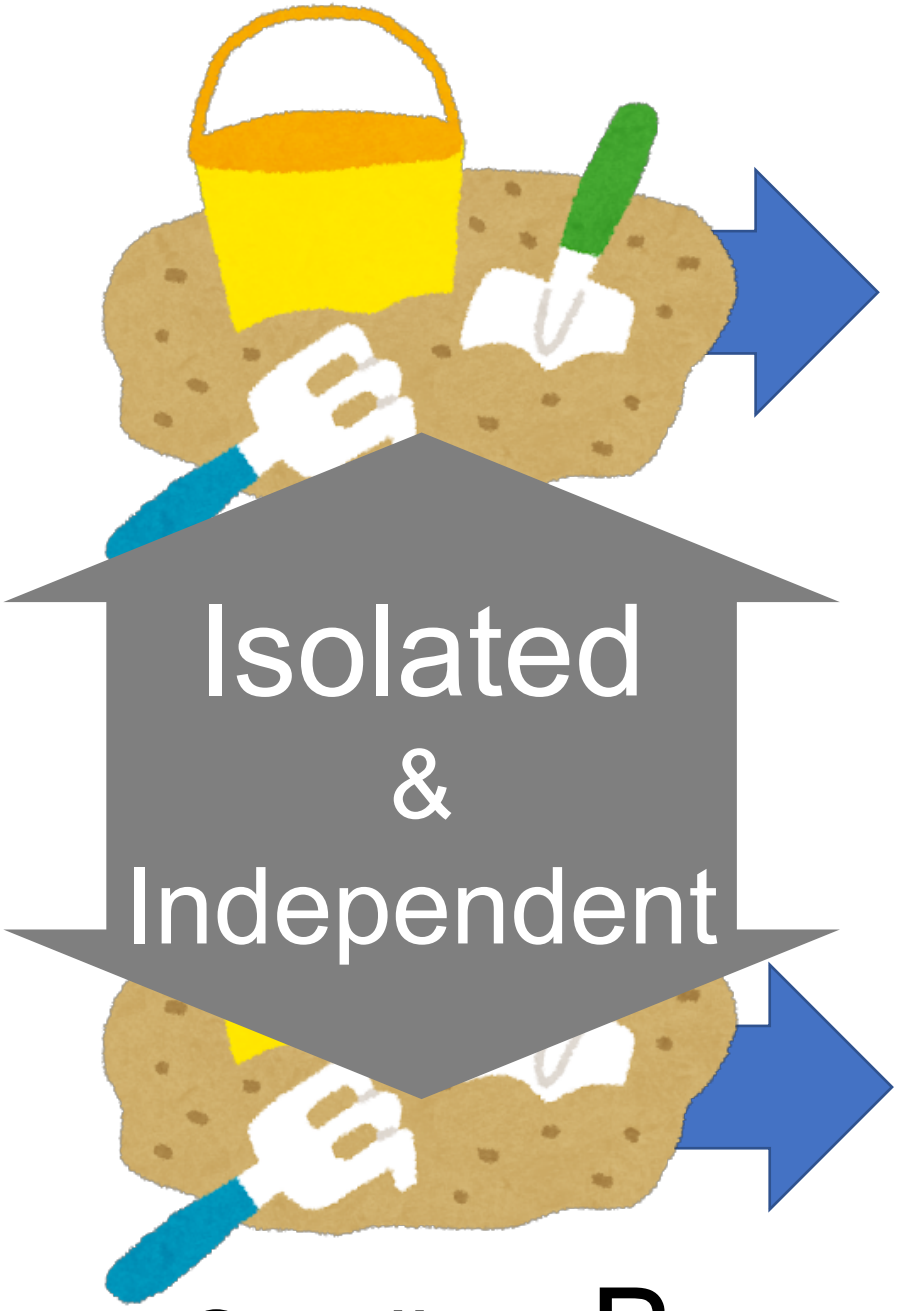

http://www.sandart-j.com/work/work3.html



Sandbox A



Sandbox B

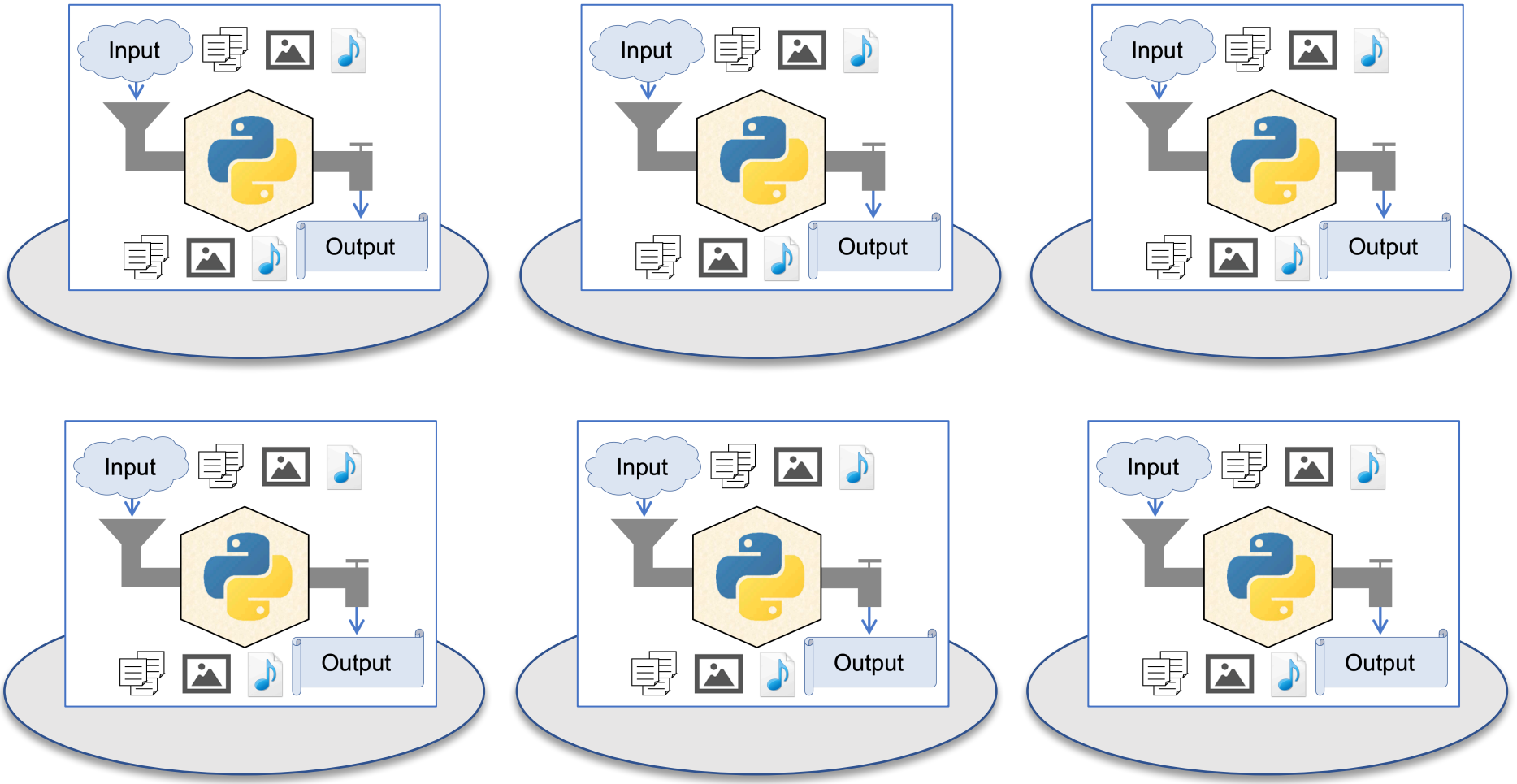


Isolated
&
Independent

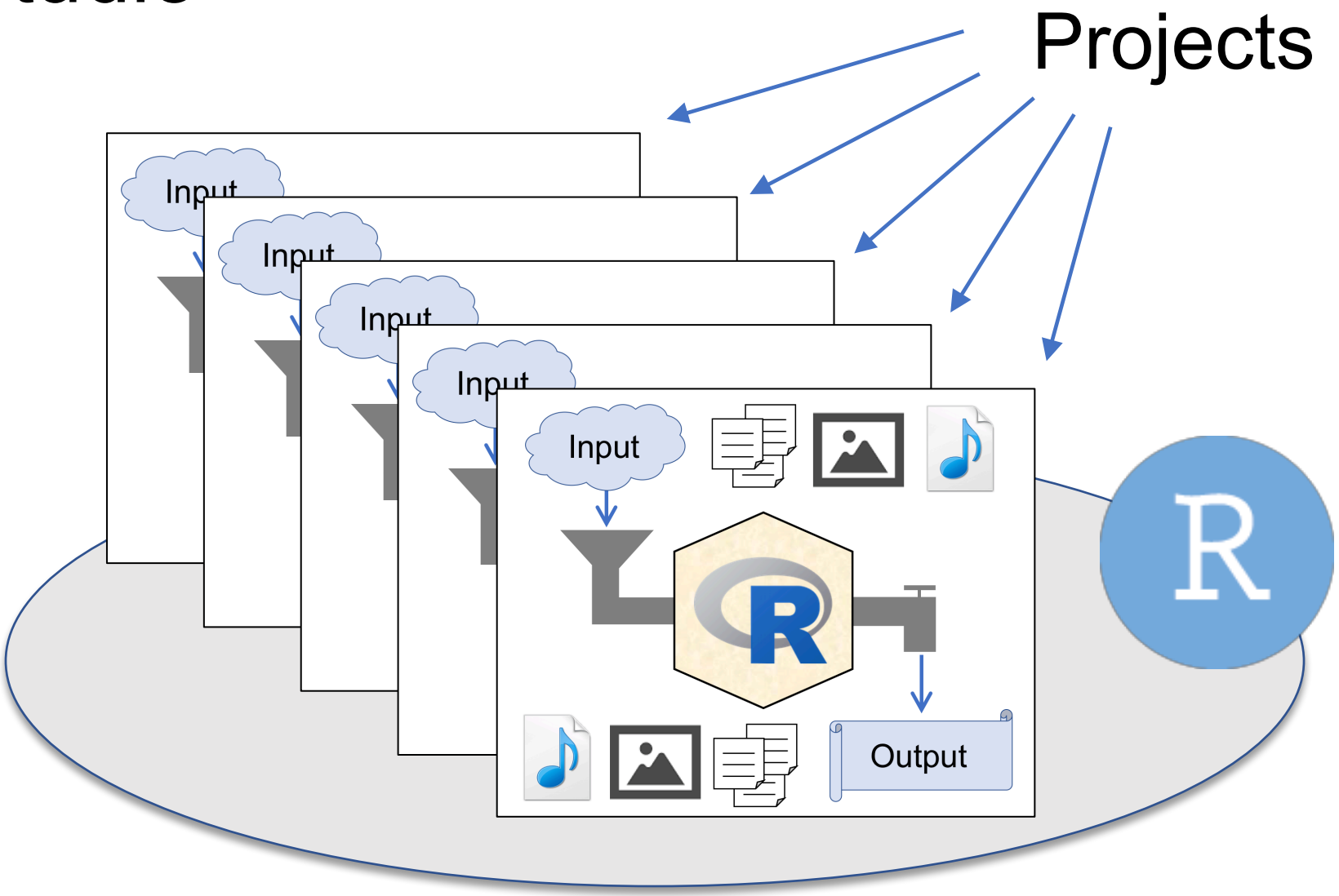
Sandbox B

"Sandboxed" Python

Isolated & Independent virtual environment for secure and reproducibility

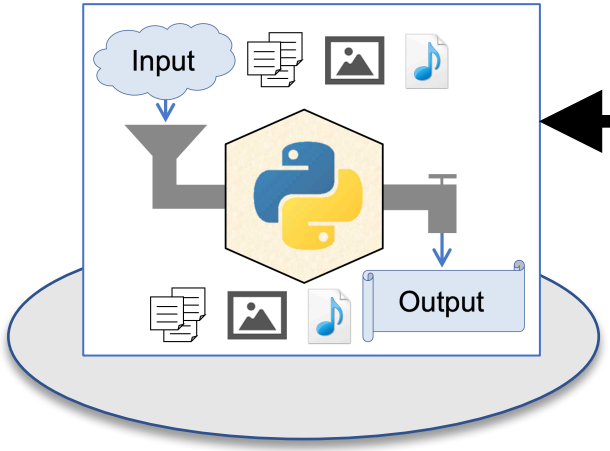


RStudio



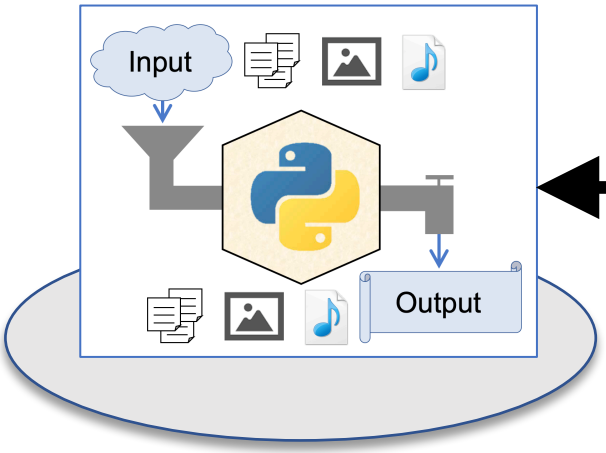
"Sandboxed" Python

Isolated & Independent virtual environment for security & reproducibility




```
[python]
version = "3.7"

[packages]
cycler==0.10.0
kiwisolver==1.1.0
matplotlib==3.1.1
numpy==1.16.4
-python==4.1.0.25
==0.25.0
ng==2.4.0
==1.1.2
```




```
[python]
version = "2.7"

[packages]
numpy==1.16.4
...
```

Pipenv

→ "Sandboxed" Python manager

Install Python

https://www.python.org/

Install Pipenv (in MacOS)

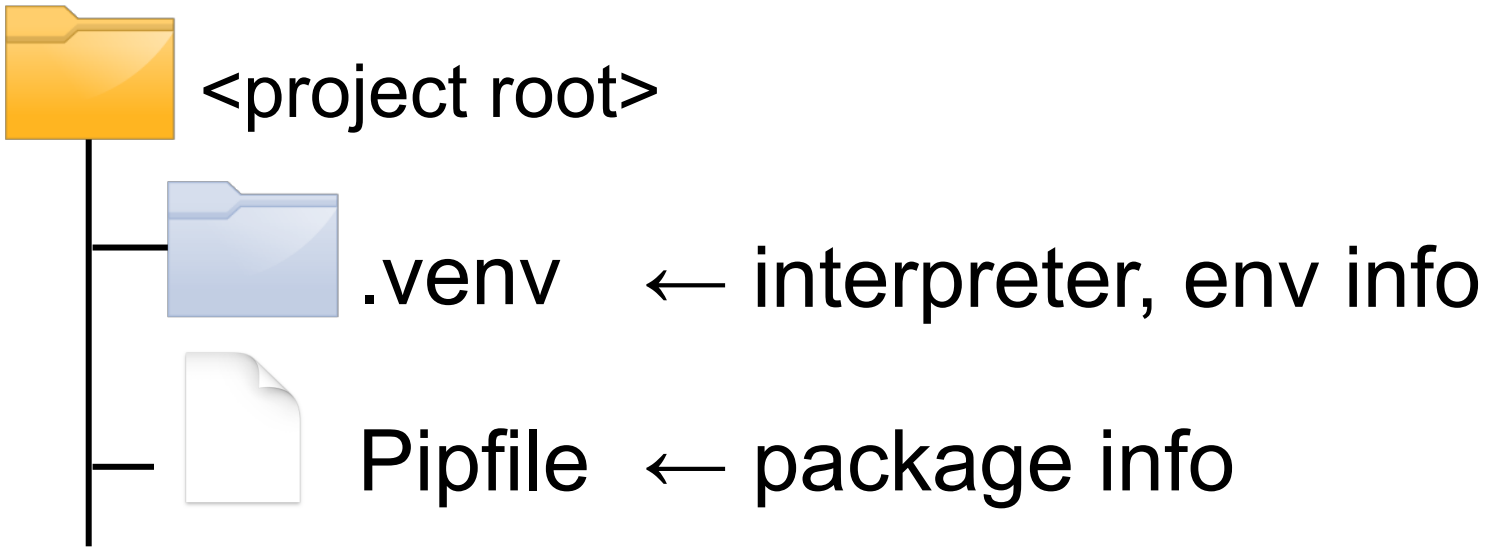
```
$ brew install pipenv
```

Pipenv

→ "Sandboxed" Python manager

Create virtualenv

```
$ cd <project root>
$ pipenv --python 3.7
```



Pipenv

→ "Sandboxed" Python manager

Activate virtualenv

```
$ pipenv shell
```

Deactivate virtualenv

```
(prj) $ exit
```

Delete virtualenv

```
$ pipenv --rm
```

Pipenv

→ "Sandboxed" Python manager

Activate virtualenv

```
$ pipenv shell
```

Install packages

```
(prj) $ pipenv install <pkg>~=<version>
```

Uninstall packages

```
(prj) $ pipenv uninstall <pkg>
```

For {reticulate},

you need NumPy package

in your virtualenv.

Pipenv

→ "Sandboxed" Python manager

Install Numpy

```
$ cd <prj>
$ pipenv shell                          # activate
(prj) $ pipenv install numpy            # install
```

```
(prj) $ pipenv run pip freeze           # check
```

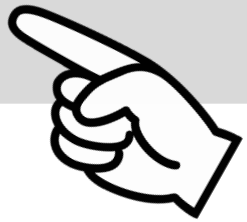
```
(prj) $ python                          # check
>>> import numpy
```

Pipenv

→ "Sandboxed" Python manager

Address of the virtualenv

```
$ cd <prj>
$ pipenv shell                    # activate
(prj) $ pipenv --venv             # check
<prj>/.venv
```



back to 

Use Python in R

Install reticulate from CRAN

```
install.packages(reticulate)
```

Attach Python virtualenv

```
library(reticulate)
pyenv <- "<prj>/.venv/bin/python"
use_python(python = pyenv,
           required = TRUE)
```

Use Python in R

Check your Python

```
py_config()
```

```
## python: <prj>/.venv/bin/python
## libpython: /Library/Frameworks/Python.framework...
## pythonhome: /Library/Frameworks/Python.fram...
## virtualenv: <prj>/.venv/bin/activate_this.py
## version: 3.7.4 (v3.7.4:e09359112e, Jul 8 2019...
## numpy: <prj>/.venv/lib/python3.7/site-packages/...
## numpy_version: 1.16.4
##
## NOTE: Python version was forced by use_python...
```

Use Python in R

Import Python pkg in R

```
os <- import("os")
```

Use Python pkg in R

```
os$listdir()
```

```
## [1] ".Rhistory"                ".DS_Store"
## [2]  ".gitignore"              ".RData"
## ...
```

Use Python in R

Import Python source file

```
source_python("sample.py")
```

sample.py

```
import pandas as pd

def pd_load_csv(path):
    df = pd.read_csv(path)
    return df

def pd_head(df, n = 3):
    return df.head(n)
```

File > New File > Python script

Use Python in R

Import Python source

```
source_python("sample.py")

dat <- pd_load_csv("hoge.csv")

pd_head(dat)

iris %>% pd_head
```

Benchmark test

```
source_python("sample.py")

f_pd <- function(path) pd_load_csv(path)
f_base <- function(path) read.csv(path)
f_readr <- function(path) readr::read_csv(path)
f_fread <- function(path) data.table::fread(path)
```

Benchmark test

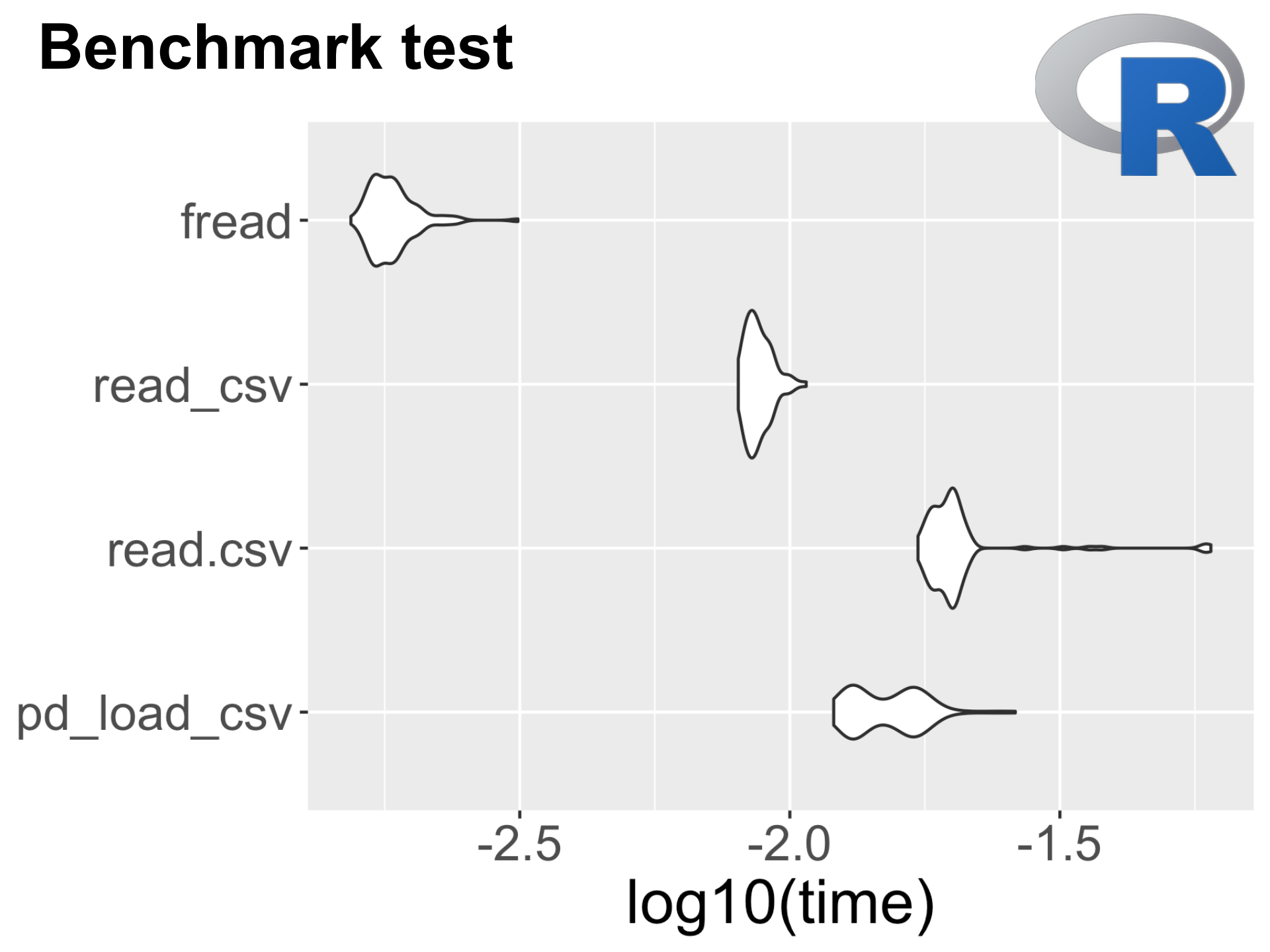
```
source_python("sample.py")

f_pd <- function(path) pd_load_csv(path)
f_base <- function(path) read.csv(path)
f_readr <- function(path) readr::read_csv(path)
f_fread <- function(path) data.table::fread(path)
```

```
microbenchmark::microbenchmark(
    pd_load_csv = f_pd(path),
    read.csv = f_base(path),
    read_csv = f_readr(path),
    fread = f_fread(path)) -> mbm

ggplot2::autoplot(mbm)
```

Benchmark test



Use Python in R

Import Python source

```
source_python("sample.py")

iris %>%
  pd_head(5)
```

```
## y_call_impl(callable, dots$args, dots$keywords)
## でエラー:
##  TypeError: cannot do slice indexing on <class
## 'pandas.core.indexes.range.RangeIndex'> with
## these indexers [5.0] of <class 'float'>
```

Variable type (basic)

Character

```
> typeof("1")
[1] "character"
```

String

```
>>> type("1")
<type 'str'>
```

Double

```
> typeof(1)
[1] "double"
```

```
> typeof(1.0)
[1] "double"
```

Float

```
>>> type(1.0)
<type 'float'>
```

Integer

```
> typeof(as.integer(1))
[1] "integer"
```

```
> typeof(1L)
[1] "integer"
```

Integer

```
>>> type(1)
<type 'int'>
```

Use Python in R

Import Python source

```
source_python("sample.py")

iris %>%
  pd_head(5)      # type ERROR

iris %>%
  pd_head(5L)     # set as integer
```

reticulate package

- Calling Python from R
  in a variety of ways including R Markdown,
  sourcing Python scripts,
  importing Python modules,
  and using Python interactively within an R session.
- Translation between R and Python objects
  (for example, between R and Pandas data frames,
  or between R matrices and NumPy arrays).

URL: https://github.com/rstudio/reticulate

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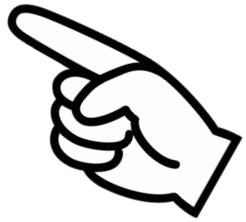

- Translation between R and Python objects
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  or between R matrices and NumPy arrays).

URL: https://github.com/rstudio/reticulate

Use Python in Rmd

Create .Rmd file

File > New File > R markdown

Import Python virturalenv in R chunk

````
```{r}
library(reticulate)
pyenv <- "<prj>/.venv/bin/python"
use_python(python = pyenv,
           required = TRUE)
```
````

Use Python in Rmd

Use Python in python chunk

````
```{python}
import pandas as pd

path = "<path>/sample.csv"

df = pd.read_csv(path)

df.head(3)
```
````

Use Python in Rmd

Use Python in python chunk

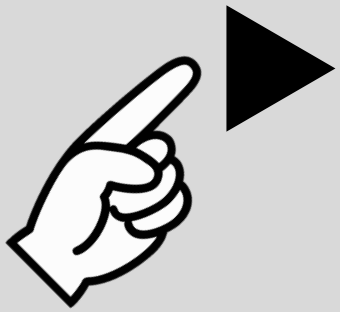
```{python}
import pandas as pd

path = "<path>/sample.csv"

df = pd.read_csv(path)

df.head(3)
```

Use Python in Rmd

Shear pyobj between pychunks

```{python}
import pandas as pd

path = "<path>/sample.csv"

df = pd.read_csv(path)
```

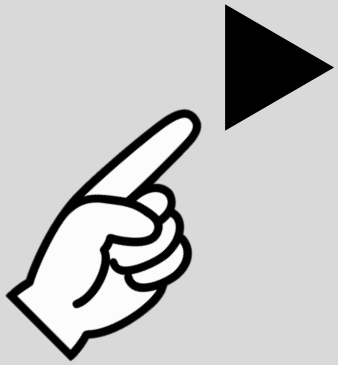
```{python}
df.head(3)
```



Use Python in Rmd

Import R object to python chunk

````
```{python}
import pandas as pd
df = r.iris
df.head(3)
```
````



Use Python in Rmd

Import R object to python chunk

````
```{python}
import pandas as pd
df = r.iris
```
````

Import python object to R chunk

````
```{r}
py <- import_main()
py$df
```
````

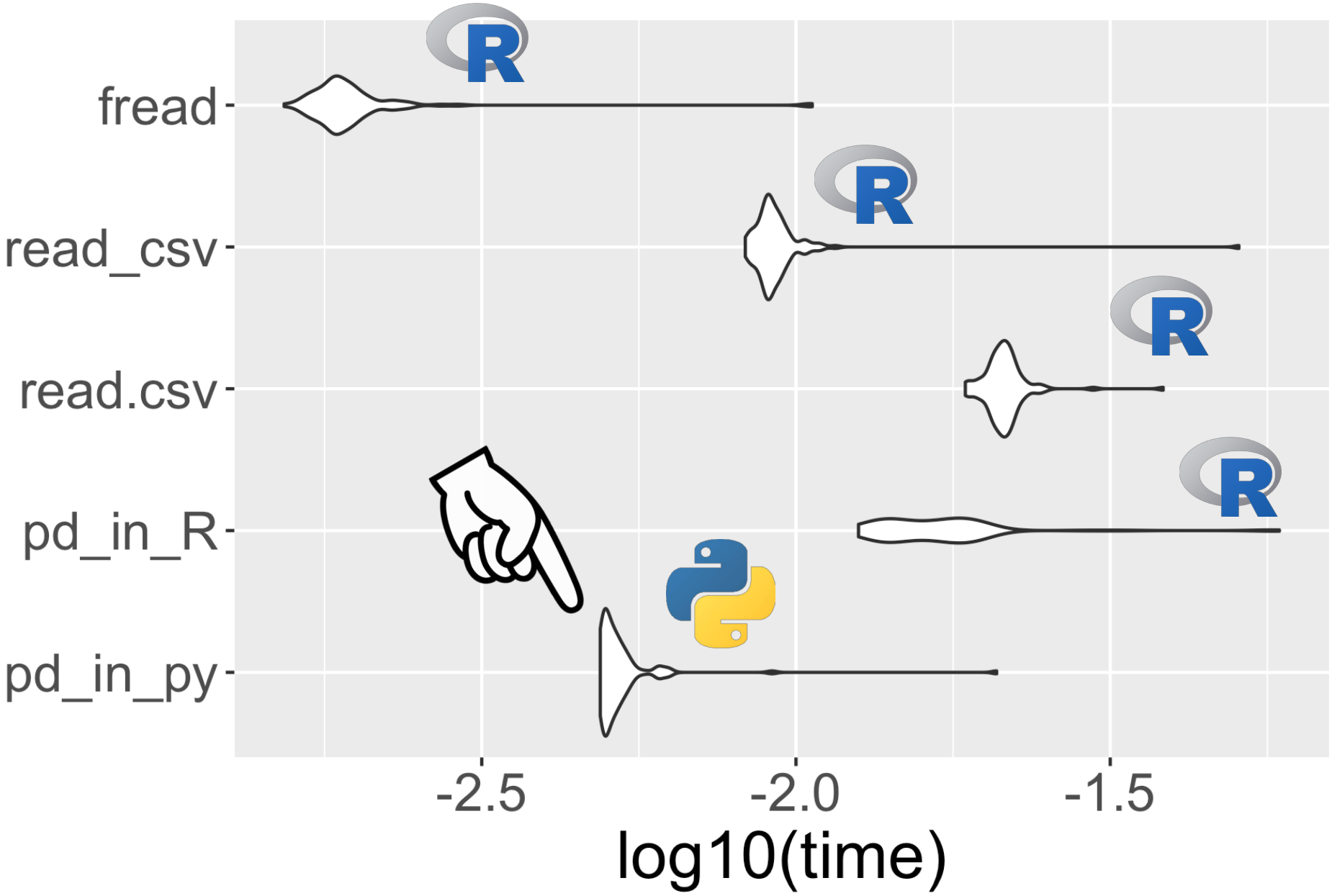
Benchmark test in python chunk

```{python}
import pandas as pd
from time import time
path = "<path>/sample.csv"

result = []
for i in range(100):
  start = time()
  df = pd.read_csv(path)
  time_i = time() - start
  result = result.append(time_i)
```

Benchmark visualization in R chunk

```{r}
py <- import_main()

py$result %>%
  data.frame(expr = "py_pd", time = .) %>%
  rbind(data.frame(mbm) %>%
          mutate(time = time/10^9)) %>%
  ggplot(aes(expr, log10(time)))+
  gem_violin()+
  coord_flip()
```

Benchmark visualization in R chunk



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Run Python in Rstudio

1. Attach Python virtualenv in R

```
library(reticulate)
pyenv <- "<prj>/.venv/bin/python"
use_python(python = pyenv,
           required = TRUE)
```

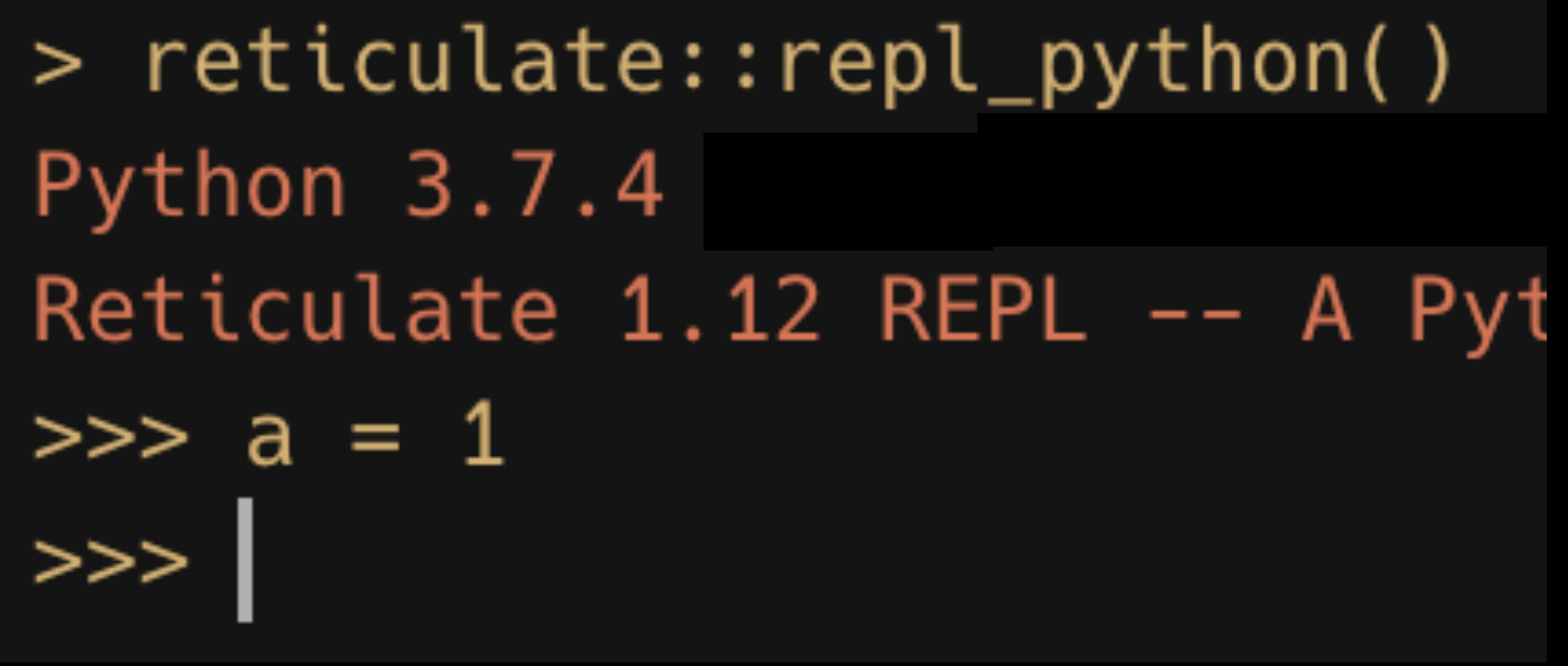
2. Create .py file

File > New File > Python script

3. write in .py file

```
a = 1
```

https://www.amazon.co.jp/dp/B00Y0UI990/


> reticulate::repl_python()
Python 3.7.4
Reticulate 1.12 REPL -- A Pyt
>>> a = 1
>>>

```
> reticulate::repl_python()
Python 3.7.4
Reticulate 1.12 REPL -- A Pyt
>>> a = 1
>>> import pandas as pd
>>> df = r.iris
>>> df.head(3)
   Sepal.Length  Sepal.Width  Pe
0           5.1          3.5
1           4.9          3.0
```

```
> reticulate::repl_python()
Python 3.7.4
Reticulate 1.12 REPL -- A Pyt
>>> import pandas as pd
>>> df = r.iris
>>>  (escape key)
> import_main()$df %>% head
  Sepal.Length Sepal.Width Petal.
1          5.1         3.5
2          4.9         3.0
```

```
> reticulate::repl_python()
>>> import pyper
>>>
>>> r = pyper.R()
>>> r("set.seed(71)")
'try({set.seed(71)})\n'
>>> r("unif_r <- runif(10, 0, 1)")
'try({unif_r <- runif(10, 0, 1)})\n'
>>>
>>> result = r.get("unif_r")
>>>
>>> result
array([0.33292806, 0.55510387, 0.3273699
```

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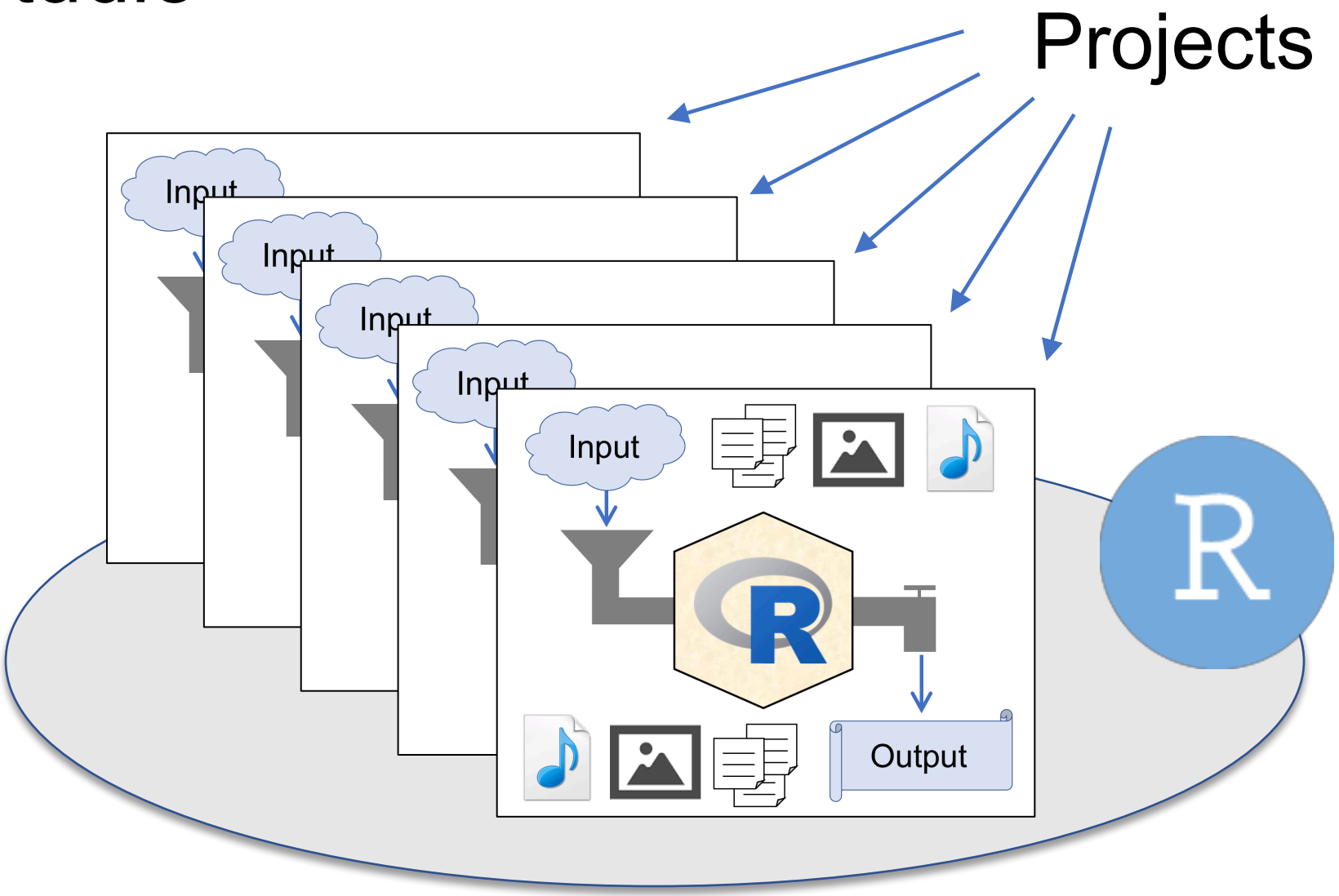
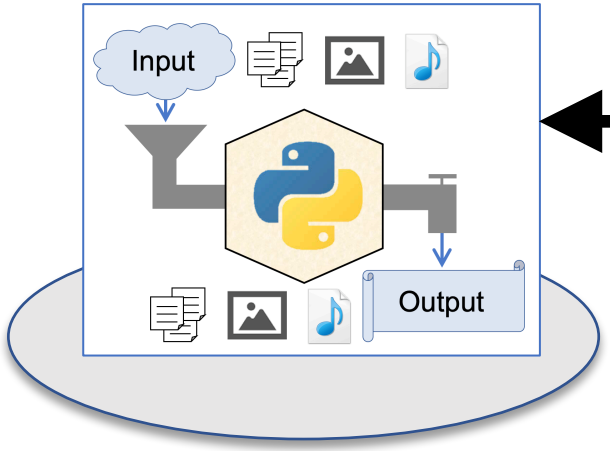
summary

RStudio

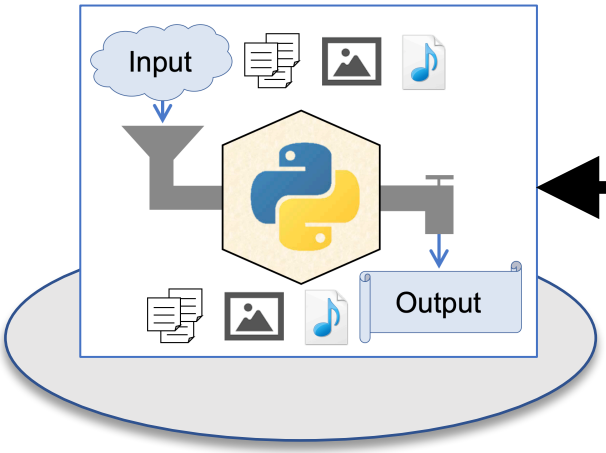


"Sandboxed" Python

Isolated & Independent virtual environment for security & reproducibility




```
[python]
version = "3.7"

[packages]
cycler==0.10.0
kiwisolver==1.1.0
matplotlib==3.1.1
numpy==1.16.4
-python==4.1.0.25
==0.25.0
ng==2.4.0
==1.1.2
```



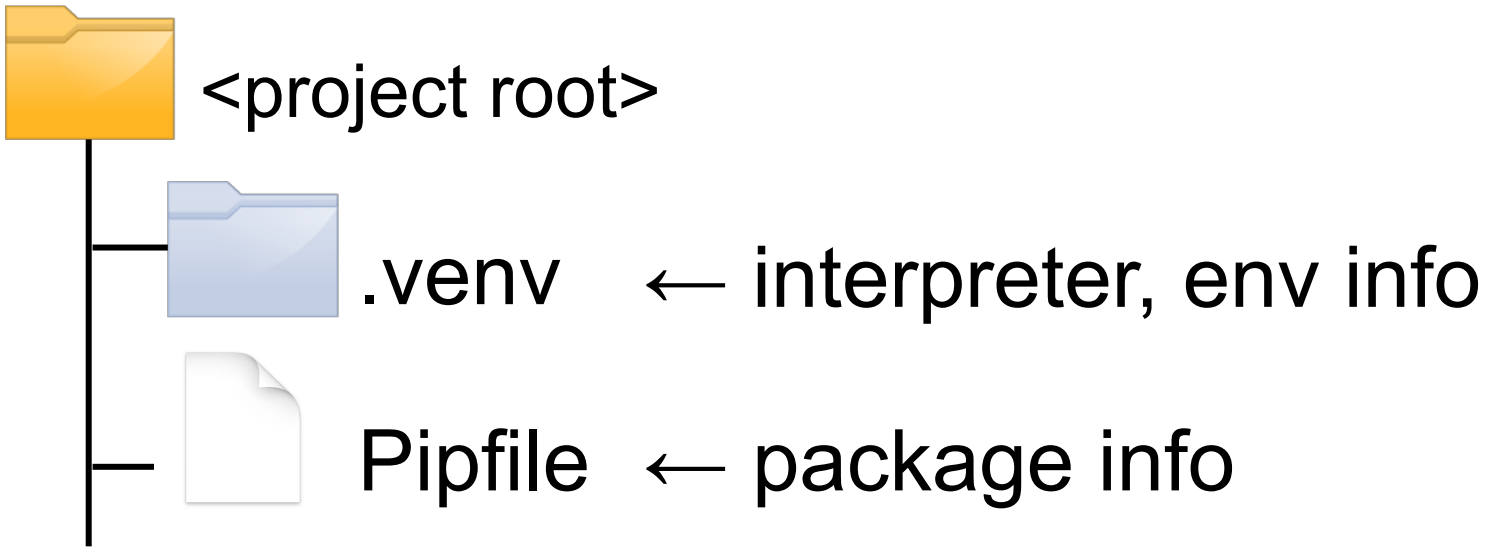

```
[python]
version = "2.7"

[packages]
numpy==1.16.4
...
```

Pipenv

→ "Sandboxed" Python manager

Create virtualenv

```
$ cd <project root>
$ pipenv --python 3.7
```



Use Python in R

Install reticulate from CRAN

```
install.packages(reticulate)
```

Attach Python virtualenv

```
library(reticulate)
pyenv <- "<prj>/.venv/bin/python"
use_python(python = pyenv,
           required = TRUE)
```

Use Python in R

Import Python source

```
pd <- import("pandas")
source_python("sample.py")
```

Shear pyobj between pychunks in Rmd

````
```{python}
import pandas as pd
path = "<path>/sample.csv"
df = pd.read_csv(path)
```
````

Run Python in Rstudio

1. Attach Python virtualenv in R

```
library(reticulate)
pyenv <- "<prj>/.venv/bin/python"
use_python(python = pyenv,
           required = TRUE)
```

2. Create .py file

File > New File > Python script

3. write in .py file

```
a = 1
```

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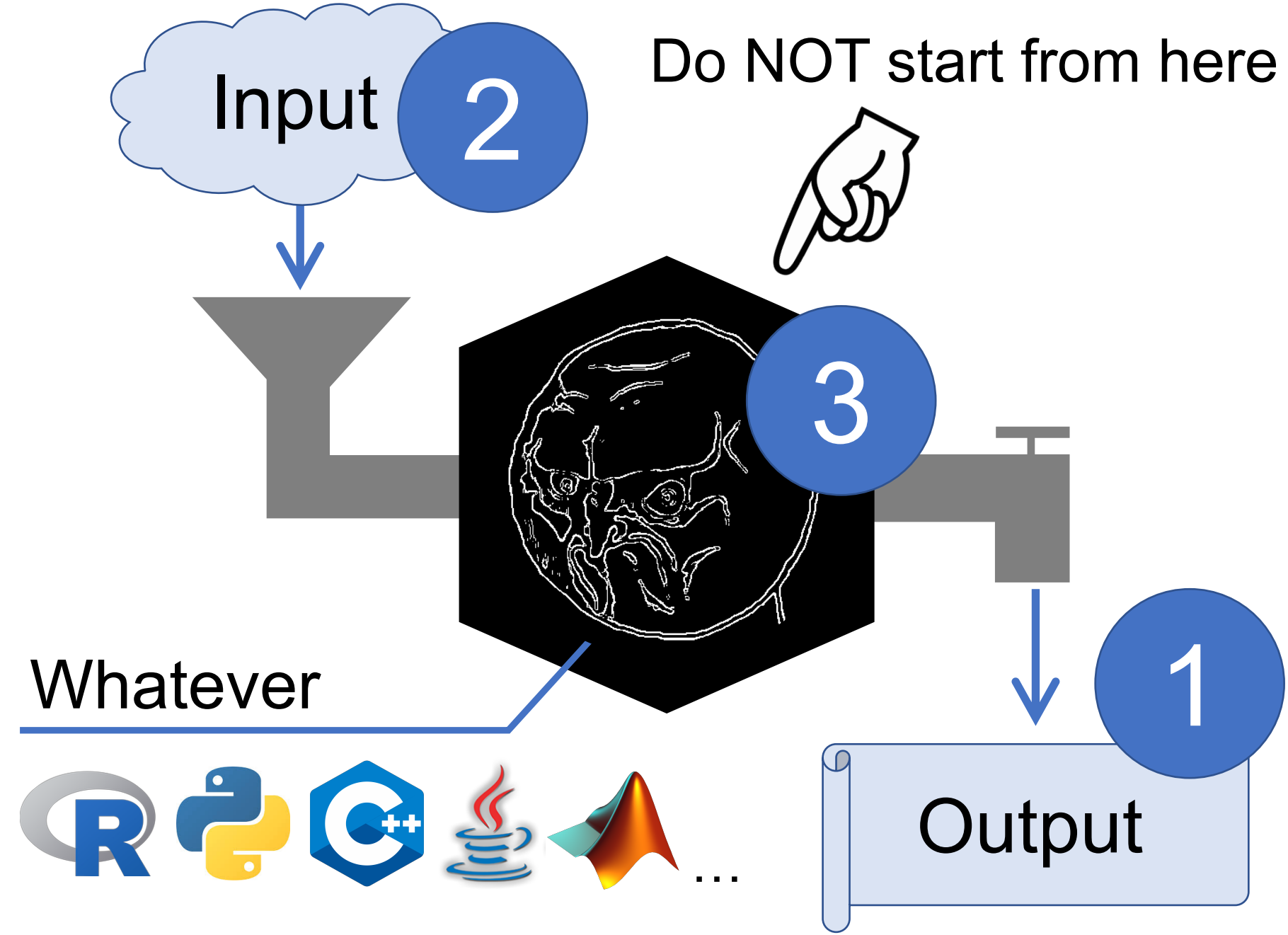
Input
2
Do NOT start from here
3
Whatever
1
Output
...