API design

I have free parking passes if you drove

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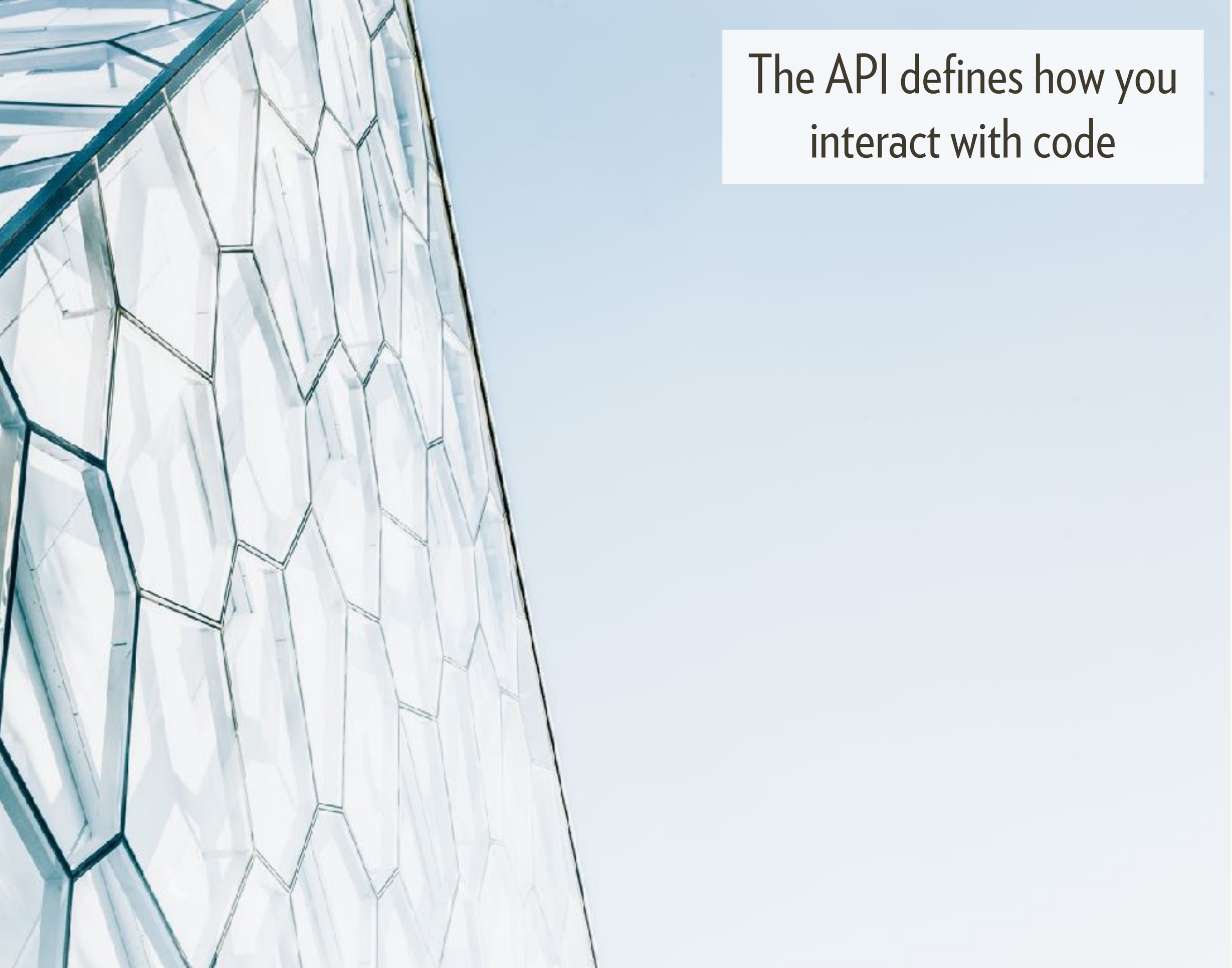

The API defines how you interact with code

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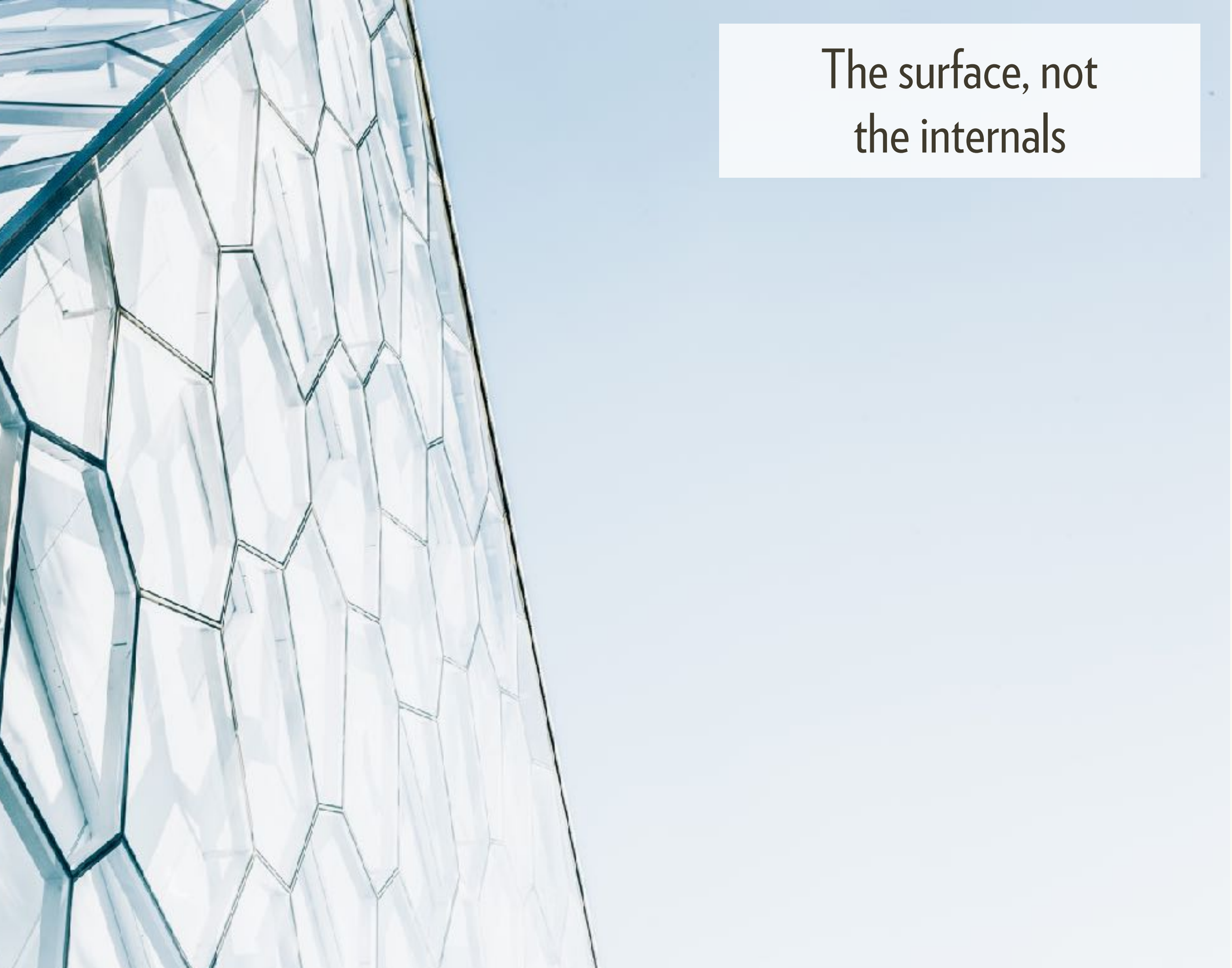


The surface, not
the internals

https://unsplash.com/photos/QeJuMpjCHQk

Case study

What makes base R functions hard to learn?

```
strsplit(x, split, ...)
grep(pattern, x, value = FALSE, ...)
grepl(pattern, x, ...)
sub(pattern, replacement, x, ...)
gsub(pattern, replacement, x, ...)
regexpr(pattern, text, ...)
gregexpr(pattern, text, ...)
regexec(pattern, text, ...)
substr(x, start, stop)
nchar(x, type, ...)
```

A few issues

Names: Function names have no common theme, and no common prefix. Names are concise at expense of expressiveness.

Arguments: Argument names & order are not consistent, and data isn't the first argument. Sometimes text, sometimes x.

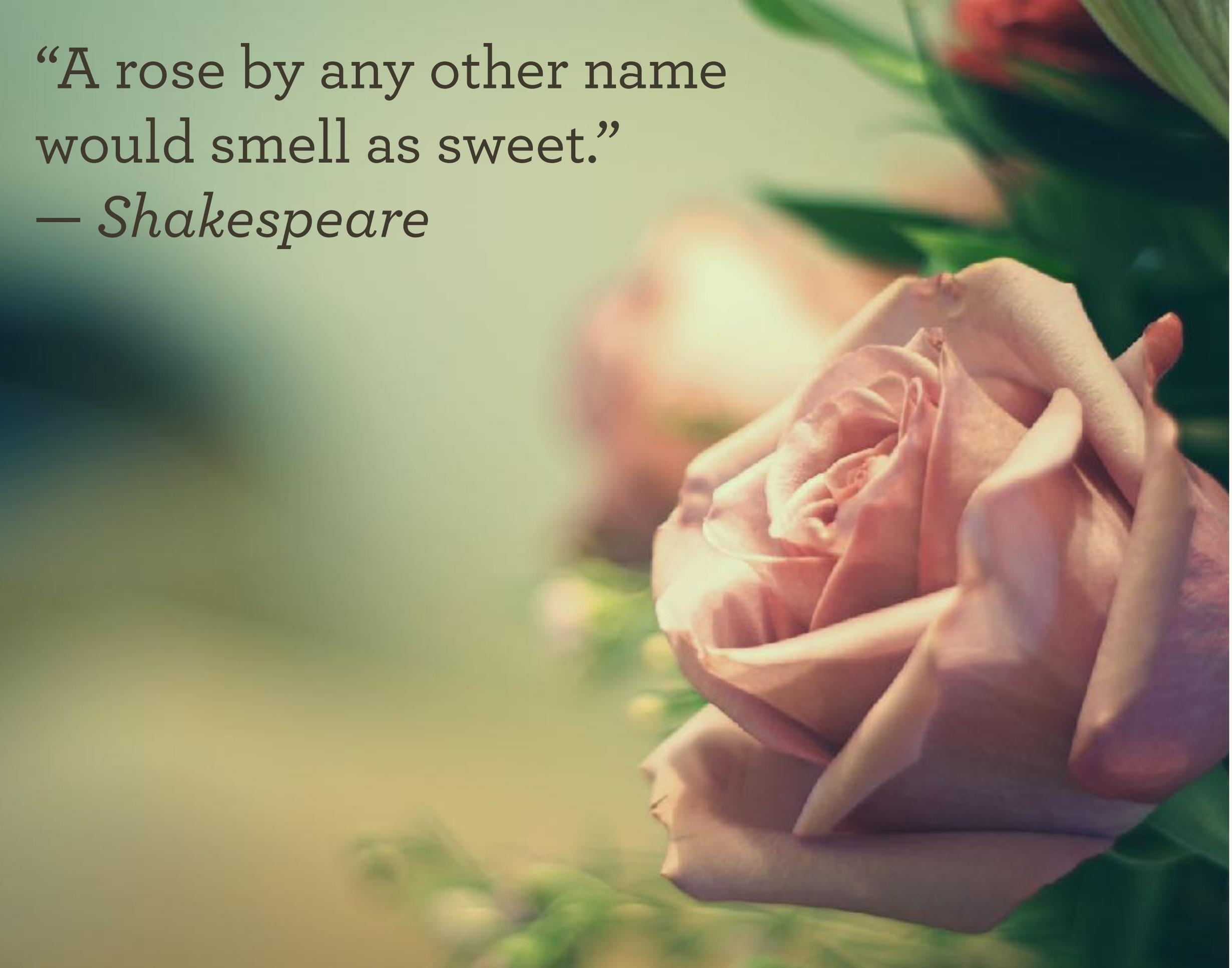
Type stability: grep() is not type stable: can return string or integer. Can't feed output of gregexpr() into substr()

https://unsplash.com/photos/HiiQsQcyO8g

“Each [function] is perfect the way it is .... and it can use a little improvement.”

—*Shunryu Suzuki*

Carefully
contemplate names



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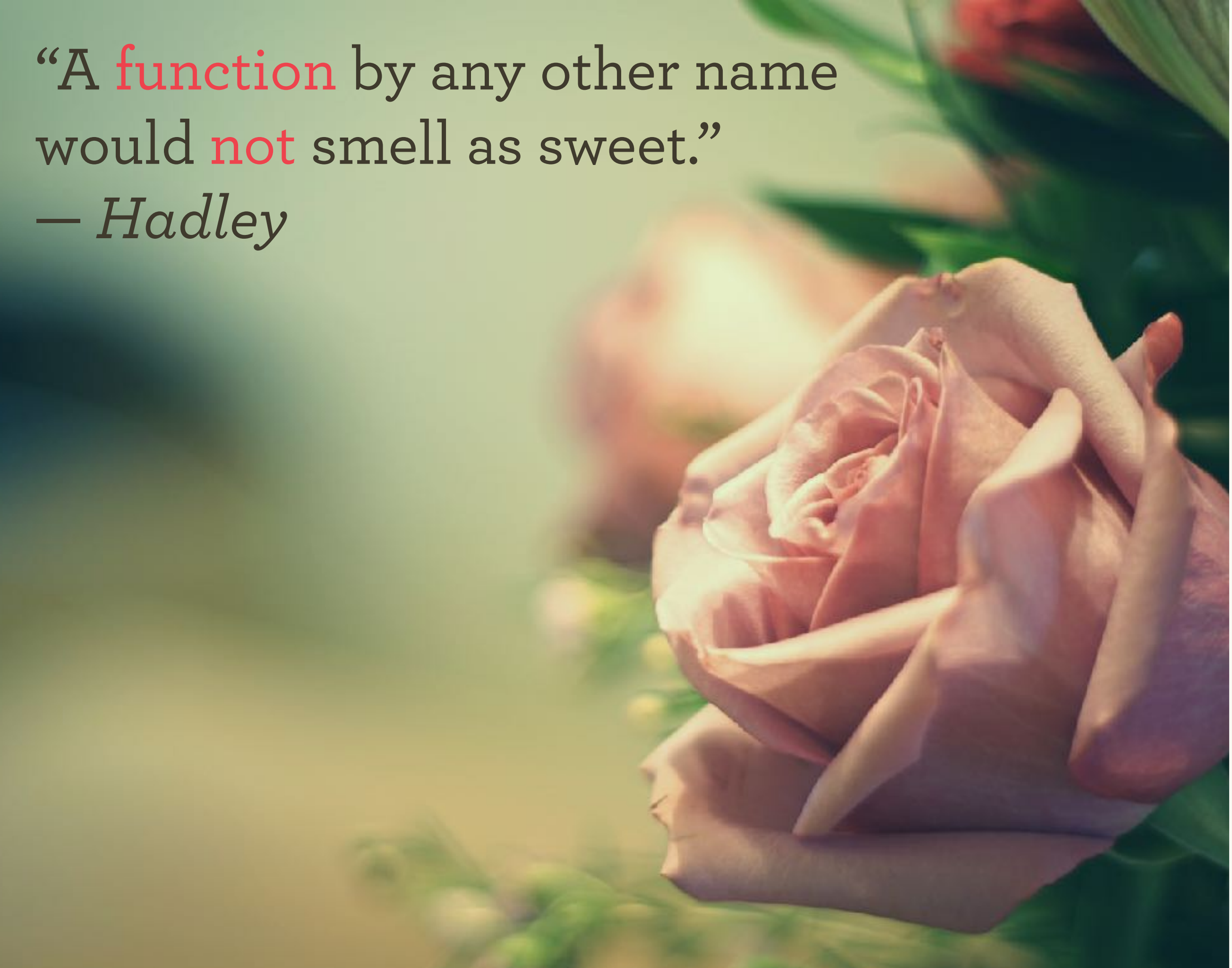
“A function by any other name would not smell as sweet.”
— *Hadley*



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Principle:

Use prefixes to group related functions together

stringr uses consistent prefixes

```
str_split()
str_detect()
str_locate()
str_replace()
```

```
# Uses suffixes for variations on a theme
str_locate_all()
str_replace_all()
```

Principle:

Whenever you can give something an informative name, you should

stringr uses evocative verbs

```
str_split()
str_detect()
str_locate()
str_subset()
str_extract()
str_replace()

# But good verbs don't always exist
str_to_lower()
str_to_upper()
```

Avoid verbs with dual meanings

```
filter()
weather()
cleave()
```

General advice

Be consistent!

Function names should be generally be verbs.

Prefer specific to general; concrete to abstract.

Avoid short names; err on the side of expressiveness.

Avoid names that differ in UK/US dialects.

Avoid names used in base R, or by similar packages.

You might get it wrong the first time

Your turn

Brainstorm functions that violate these principles (particularly within the tidyverse!)

Plan for pipes

Why is the pipe useful?

```
library(dplyr)
by_dest <- group_by(flights, dest)
dest_delay <- summarise(by_dest,
  delay = mean(dep_delay, na.rm = TRUE),
  n = n()
)
big_dest <- filter(dest_delay, n > 100)
arrange(big_dest, desc(delay))
```

But naming is hard work

```
foo <- group_by(flights, dest)
foo <- summarise(foo,
  delay = mean(dep_delay, na.rm = TRUE),
  n = n()
)
foo <- filter(foo, n > 100)
arrange(foo, desc(delay))
```

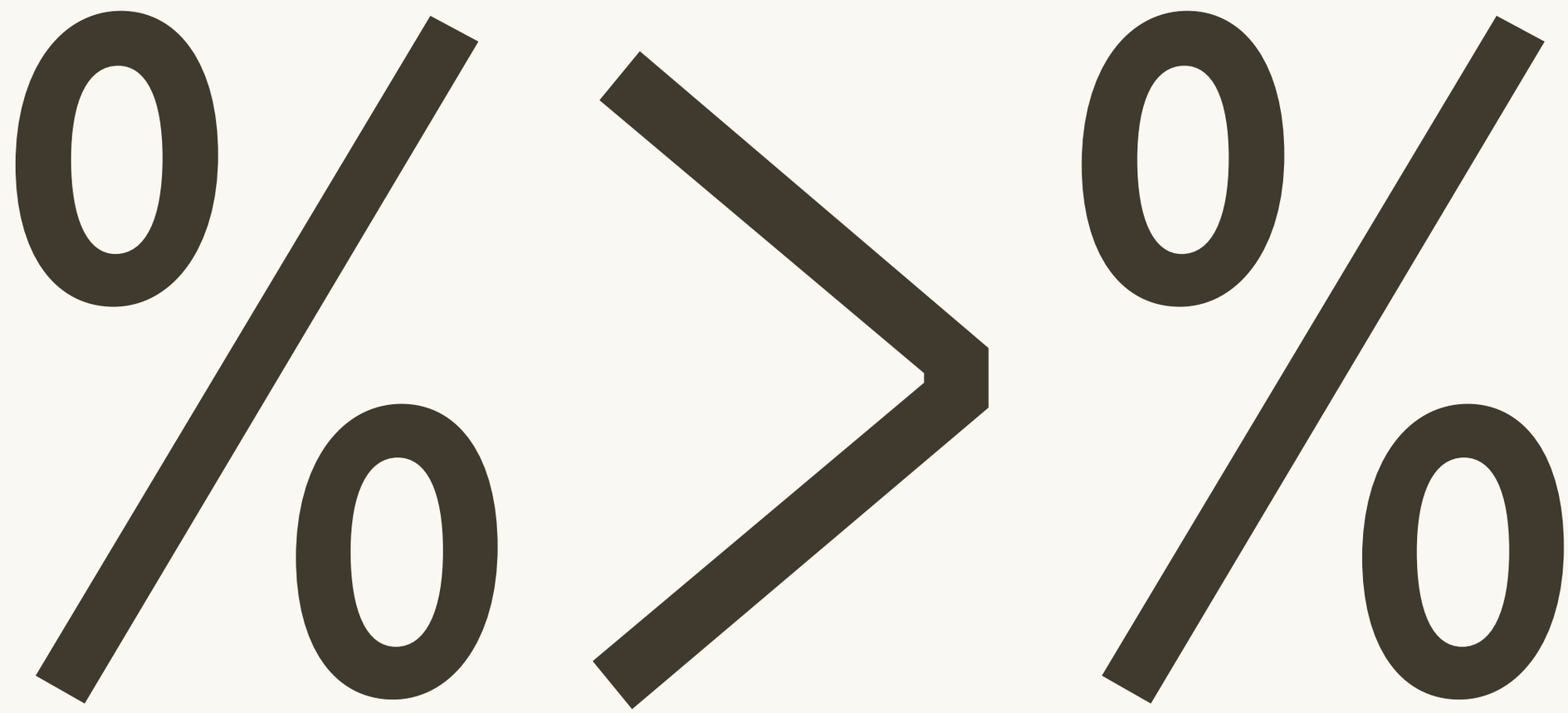
But naming is hard work

```
foo1 <- group_by(flights, dest)
foo2 <- summarise(foo1,
  delay = mean(dep_delay, na.rm = TRUE),
  n = n()
)
foo3 <- filter(foo2, n > 100)
arrange(foo2, desc(delay))
```

Alternatively, you *could* nest function calls

```
arrange(
  filter(
    summarise(
      group_by(flights, dest),
      delay = mean(dep_delay, na.rm = TRUE),
      n = n()
    ),
    n > 100
  ),
  desc(delay)
)
```

magrittr provides a third option



No intermediaries; read from left-to-right

```
flights %>%
  group_by(dest) %>%
  summarise(
  delay = mean(dep_delay, na.rm = TRUE),
  n = n()
) %>%
filter(n > 100) %>%
arrange(desc(delay))
```

	Read left-to-right	Can omit intermediate names	Non-linear
`y <- f(x)` `g(y)`	✅		✅
`g(f(x))`		✅	✅

`x %>%`
`  f() %>%`
`  g()`
	✅	✅	

Principle:

Data arguments should come first

Most arguments fall in one of two classes

Data	Details
Required	Optional
Core data	Additional options
Often vectorised	Scalar
Often called x or data	Names are important

```
# Typically you can omit the names og the
# data arguments
ggplot(mtcars, aes(x = disp, y = cyl))

ggplot(data = mtcars, mapping = aes(...))

# Typically you shouldn't omit the names of
# of the details argument
mean(1:10, , TRUE)
mean(1:10, na.rm = TRUE)
```

Your turn

Which are the data arguments in grepl()?
Which are the details?

Which are the data arguments in strsplit()?
Which are the details?

Which are the data arguments in substr()?
Which are the details?

Which are the data arguments in merge()?
Which are the details?

```
x %>%
  str_replace("a", "A") %>%
  str_replace("b", "B")
```

```
x %>%
  gsub("a", "A", .) %>%
  gsub("b", "B", .)
```

Principle:

Match outputs and inputs

Your turn

```
x <- c("bbaab", "bbb", "bbaaba")
loc <- regexpr("a+", x)

# What does regexpr() return? What data
# structure does it use?

# How do you use the result of regexpr()
# to extract the match? (with substr())
```

Output of regexp() not compatible with substr()

```
x <- c("bbaab", "bbb", "bbaaba")
regexpr("a+", x)

loc <- regexpr("a", x)
substr(x, loc, loc + attr(loc, "match.length"))

# And only works because this returns ""
substr(x, -1, -2)
```

Equivalent stringr code is much simpler

```
x <- c("bbaab", "bbb", "bbaaba")
str_sub(x, str_locate(x, "a+"))
```

```
# All matches
loc <- str_locate_all(x, "a+")
map2(x, loc, str_sub)
```

Type stability and stringr

```
# Instead of suffixes
str_replace()
str_replace_all()

# could use an argument
str_replace(n = 1)
str_replace(n = Inf)

# which generalises better
str_replace(n = 2)
str_replace(n = -1)
```

But that would violate type stability

```
strings <- c("x y", "x y x")
str_locate(strings, "x", n = 1)
#>      start end
#> [1,]     1   1
#> [2,]     1   1
```

```
str_locate(strings, "x", n = Inf)
#> [[1]]
#>      start end
#> [1,]     1   1
#>
#> [[2]]
#>      start end
#> [1,]     1   1
#> [2,]     5   5
```