Interface design

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The interface defines how you interact with code

interface = outside
implementation = inside

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: No common theme. No common prefix. Names are concise at expense of expressiveness. (who is Greg?)

Arguments: Argument names & order are not consistent, and data isn't the first argument (2nd or 3rd). Sometimes text, sometimes x.

Inconvenient outputs: Can't feed output of gregexpr() into substr()

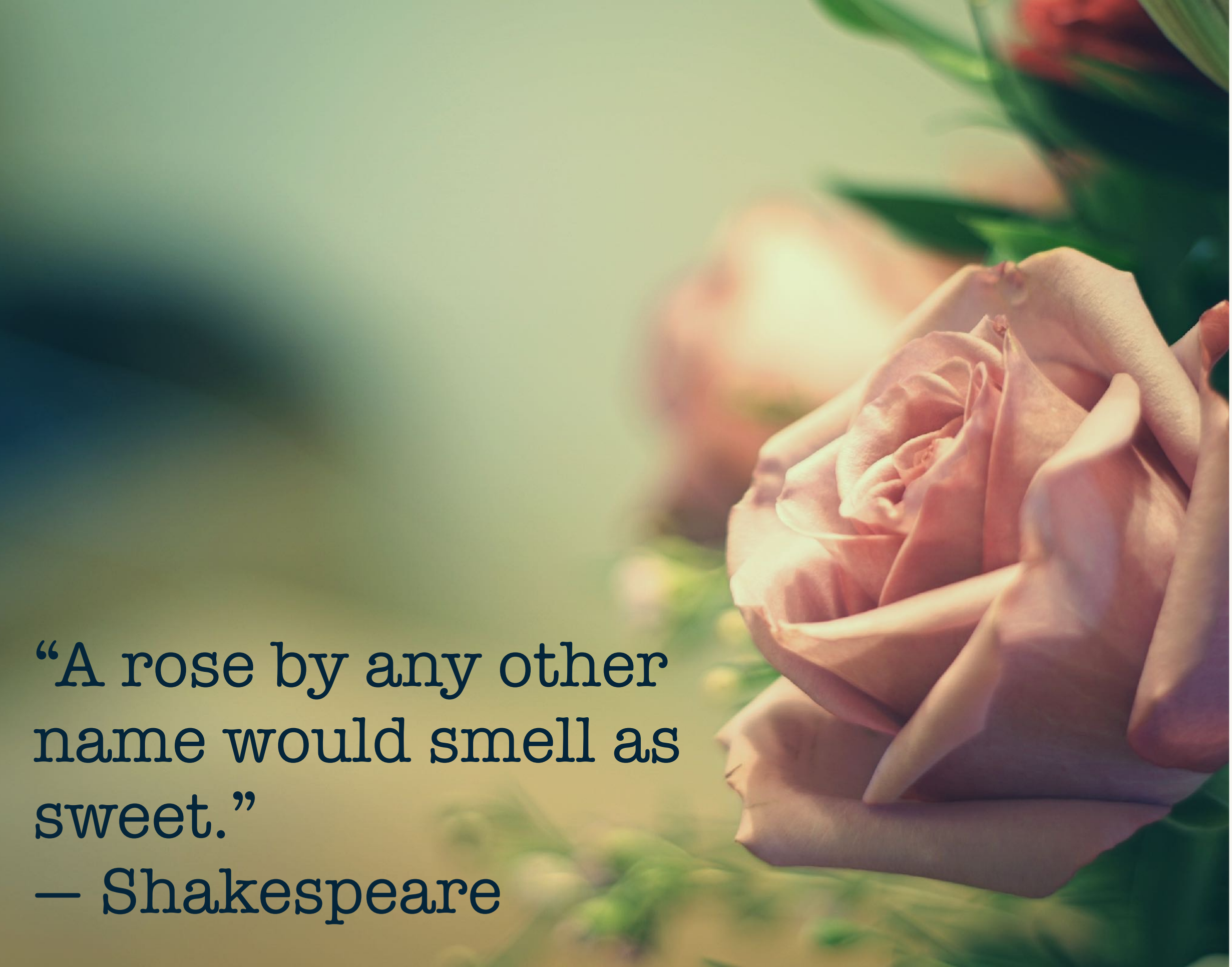
https://unsplash.com/photos/HiiQsQcyO8g


stringr
www.rstudio.com

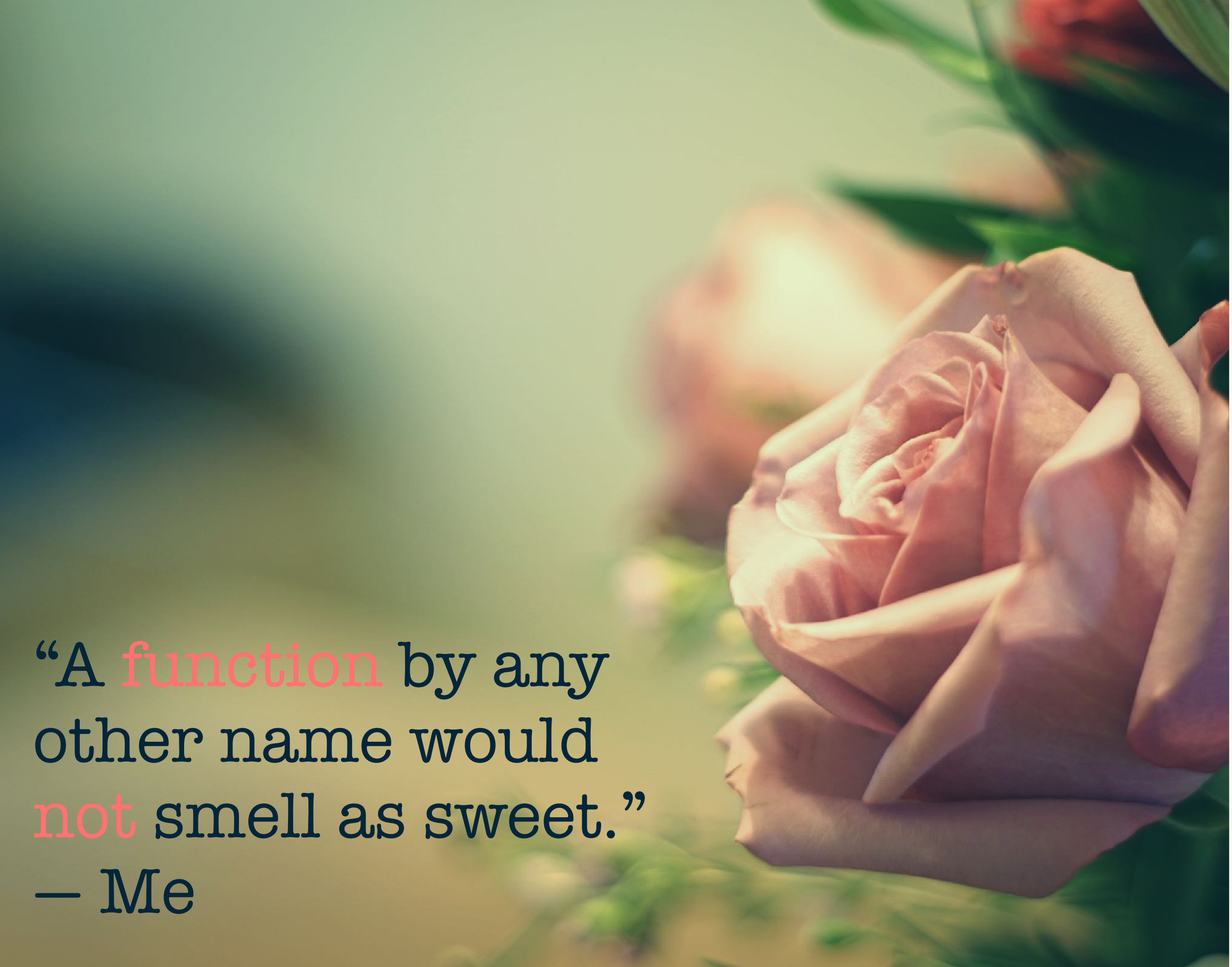
“Each [function] is perfect the way it is …. and it can use a little improvement.”

—Shunryu Suzuki

Think about names



https://unsplash.com/photos/wwokZzl_gcw



https://unsplash.com/photos/wwokZzl_gcw

Principle:

Use verbs for action functions

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()
```

ggplot2 uses nouns

```
geom_line()
scale_x_continuous()
coord_fixed()
```

Past mistakes

```
# Avoid verbs with dual meanings
weather()
cleave()
filter()

# Avoid words with UK/US variants
summarise() / summarize()
scale_colour_grey() / scale_color_gray()
```

Principle:

Use prefixes to group related functions together

Most stringr functions start with str_

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

Principle:

Use suffixes for variations on a theme

Use suffixes for variations on a theme

```
str_extract()
str_extract_all()

str_replace()
str_replace_all()

str_split()
str_split_fixed()
```

Your turn

What stringr functions violate these principles?

What other tidyverse functions violate these principles?

```
# Don't start with str_
invert_match()
word()
fixed()
regexp()

# Aren't verbs
str_which()
str_c()
str_length()
str_sub()
```

Plan for the pipe

Why is the pipe useful?

```
library(dplyr)
library(nycflights13)

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))
```

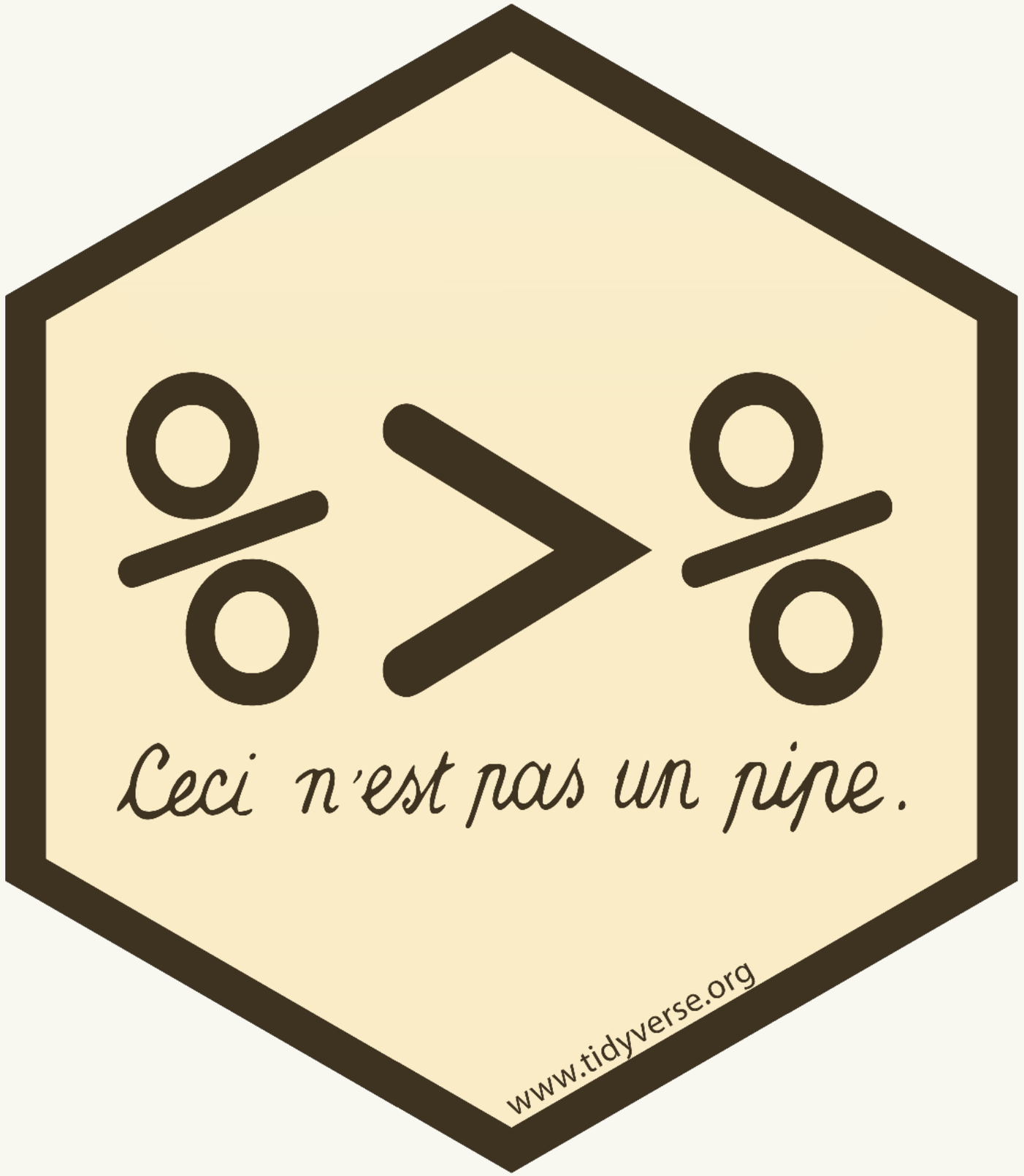
But naming is hard work

```
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 way



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

These affect how you call functions

```
# Omit names of the data arguments
ggplot(mtcars, aes(x = disp, y = cyl))
# Not
ggplot(data = mtcars, mapping = aes(...))
```

```
# Provide names of details arguments
mean(1:10, na.rm = TRUE)
# Not
mean(1:10, , TRUE)

# Never use partial names
```

Your turn

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

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

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

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

Can use . if data doesn't come first

```
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 substr() with the result
# of regexpr() to extract the match?
```

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") - 1)

# And only works because this returns ""
substr(x, -1, -3)

# regmatches() has a different problem
regmatches(x, loc)
```

Equivalent stringr code is much simpler

```
x <- c("bbaab", "bbb", "bbaaba")
str_sub(x, str_locate(x, "a+"))
# NB: str_sub() accepts positions in two ways:
# str_sub(x, start, end) OR
# str_sub(x, cbind(start, end))

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

https://principles.tidyverse.org/args-required.html