Practical Approaches to Bioanalysis in R

Intro to the tidyverse & making data tidy with tidyr

*Many of these slides have been contributed by or modified from slides contributed by Dr. Claus Wilke

Tidy data

“Tidy datasets are all alike but every messy dataset is messy in its own way” — Hadley Wickham

Tidy data

Three rules:

1. Each variable forms a column
2. Each observation forms a row
3. Each type of observational unit forms a table

Example: Contingency table

	survived	died
drug	15	3
placebo	4	12

not tidy

Example: Contingency table

	survived	died
drug	15	3
placebo	4	12

not tidy

tidy

treatment	outcome	count
drug	survived	15
drug	died	3
placebo	survived	4
placebo	died	12

Example: Contingency table

	survived	died
drug	15	3
placebo	4	12

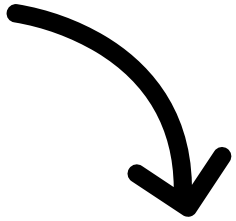
not tidy

tidy

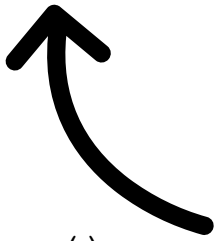
patient	treatment	outcome
1	drug	survived
2	drug	died
3	drug	survived
4	placebo	died
⋮	⋮	⋮

`tidyr` library provides functions for transforming tables

	survived	died
drug	15	3
placebo	4	12



`pivot_longer()`



`pivot_wider()`

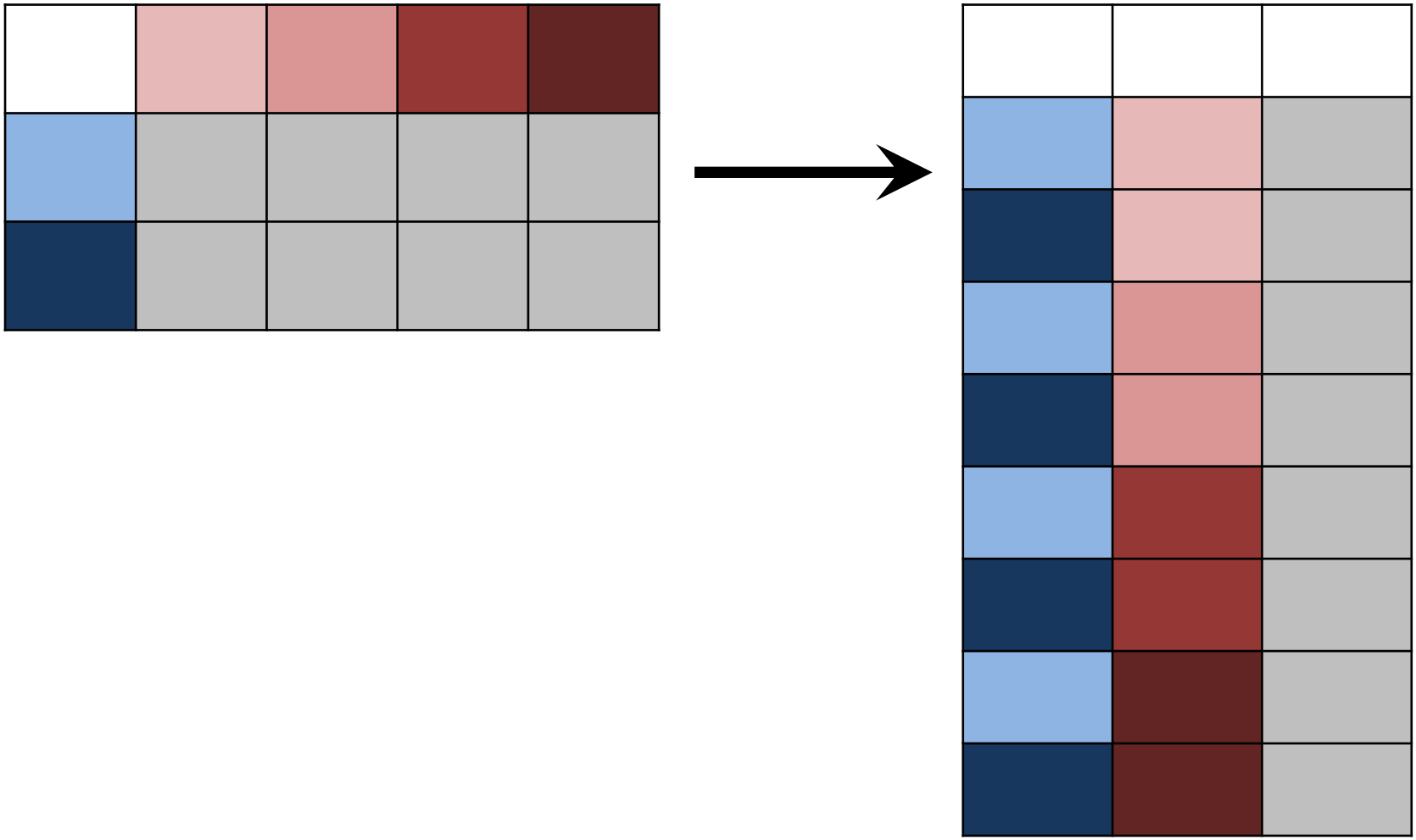
patient	treatment	outcome
1	drug	survived
2	drug	died
3	drug	survived
4	placebo	died
⋮		

Making data sets longer or wider

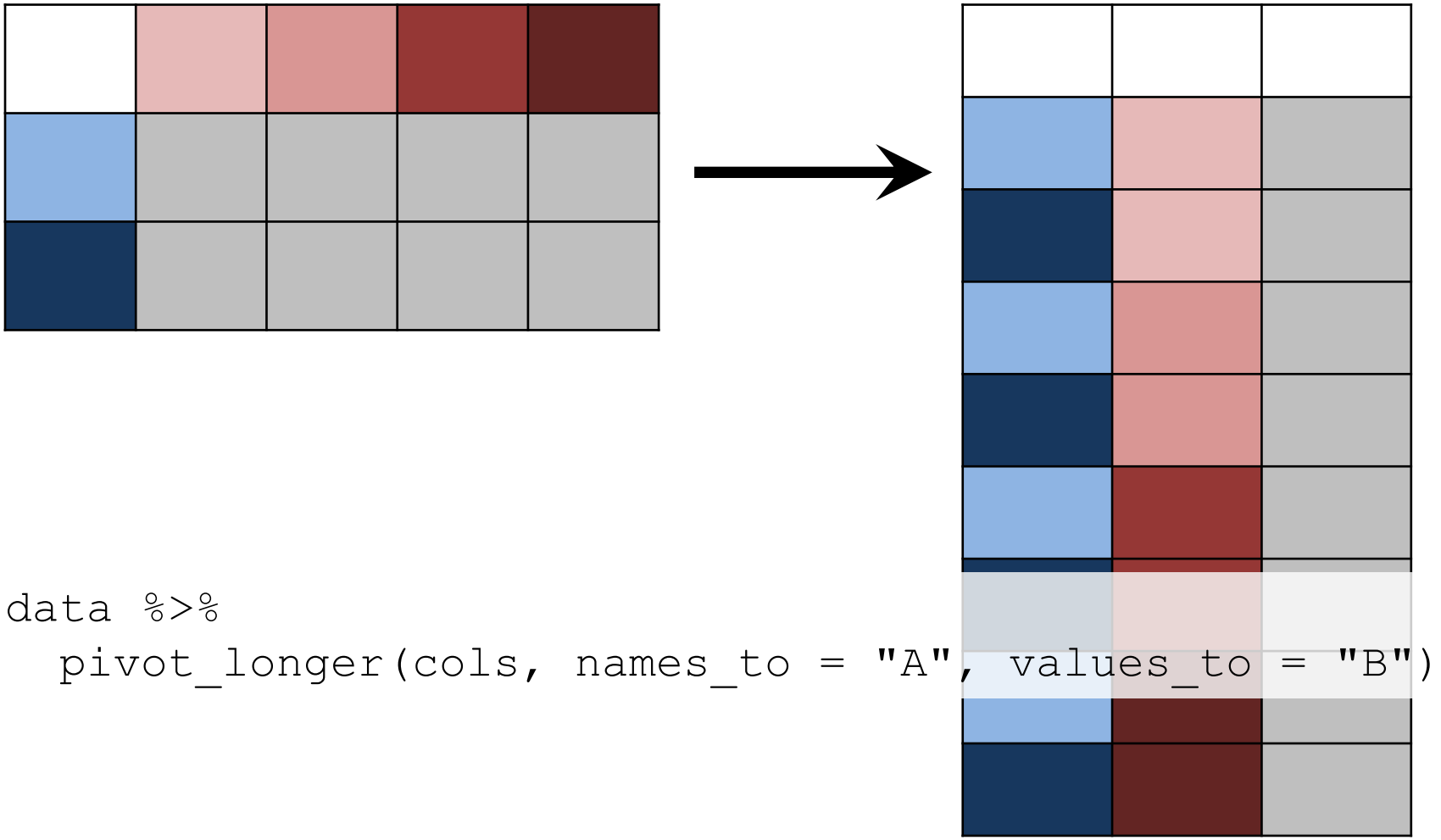
We'll be discussing two functions:

- `pivot_longer()` — make a wide table long
- `pivot_wider()` — make a long table wide

pivot_longer()

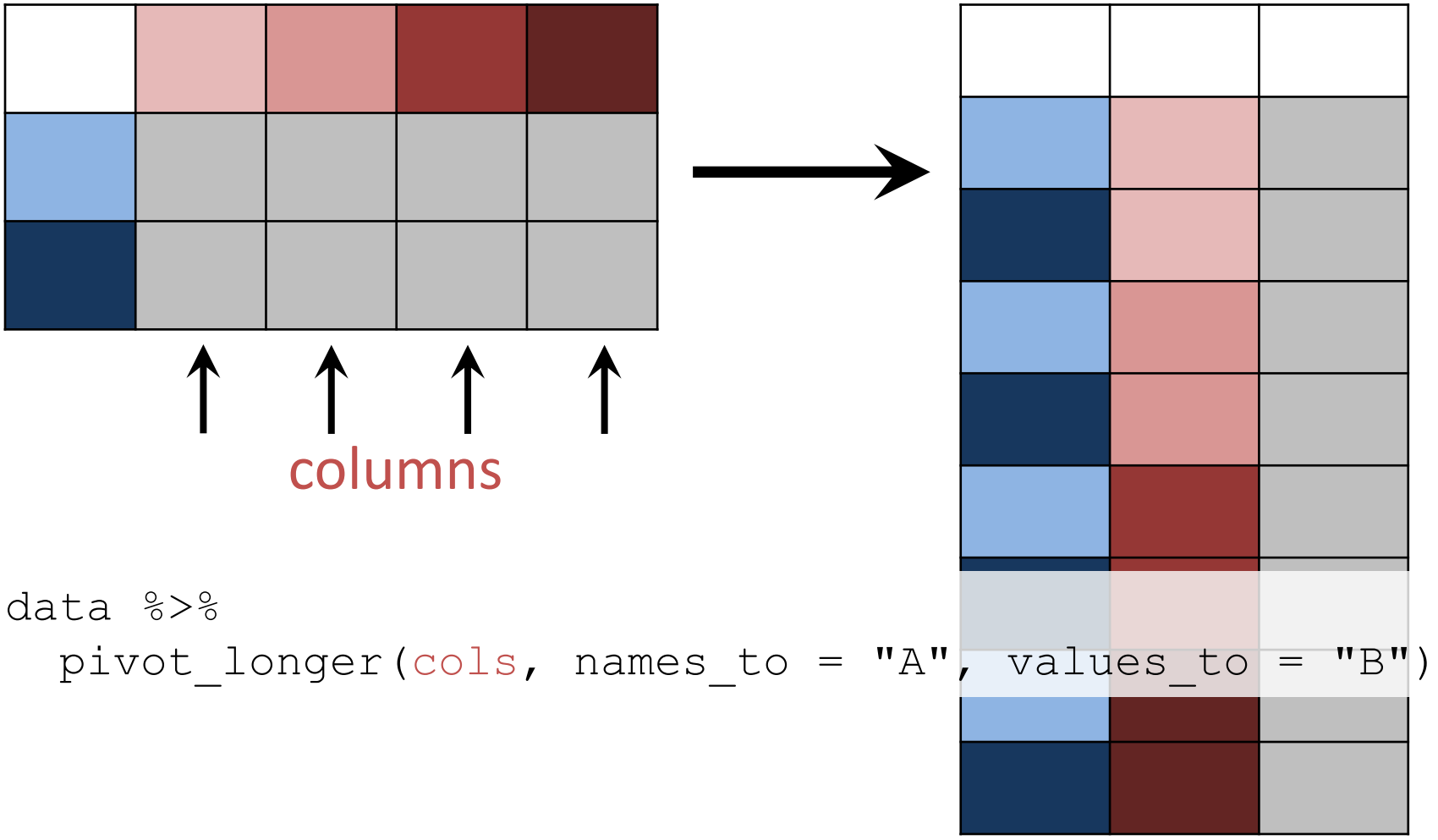


pivot_longer()



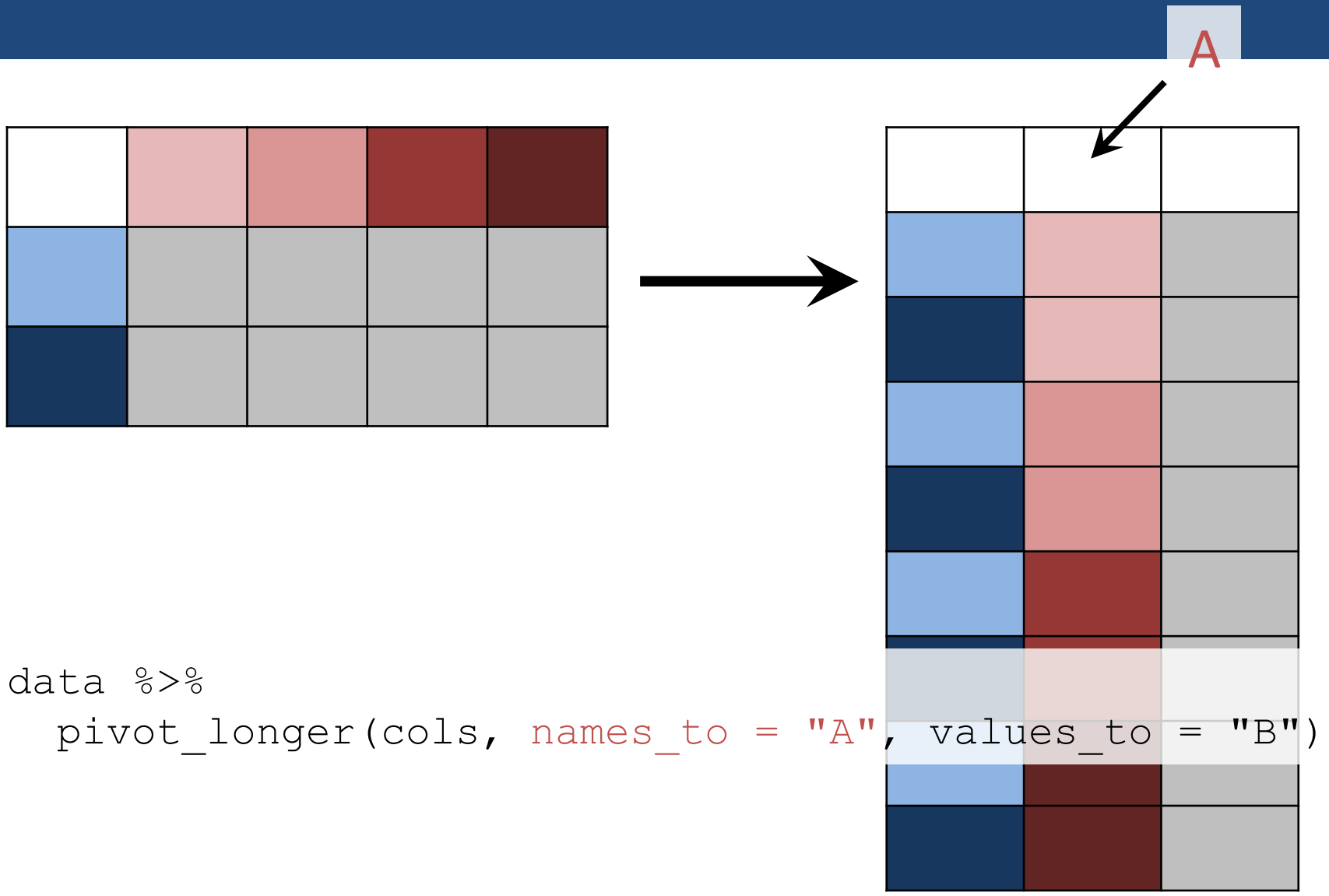
```
data %>%
  pivot_longer(cols, names_to = "A", values_to = "B")
```

pivot_longer()



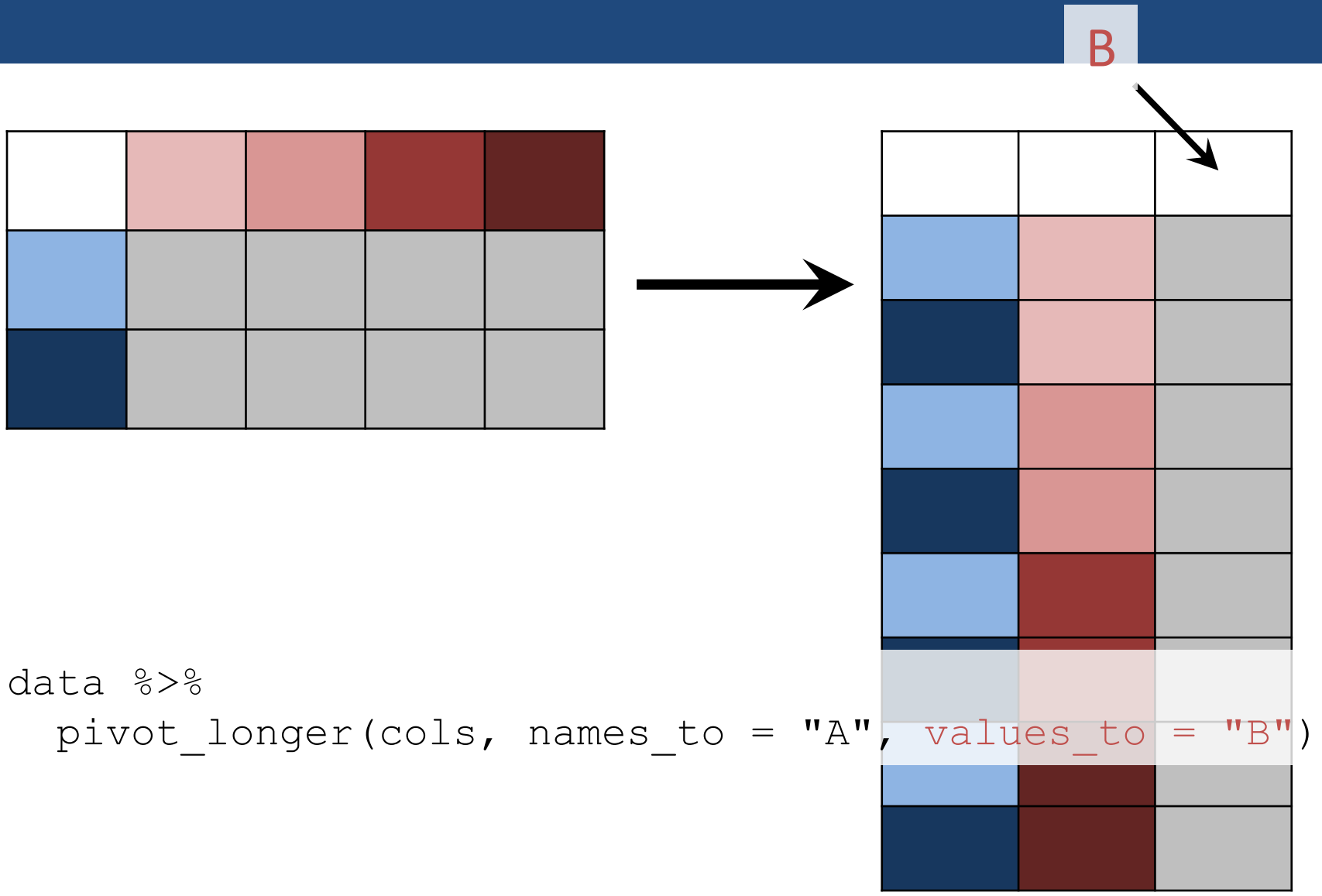

```
data %>%
  pivot_longer(cols, names_to = "A", values_to = "B")
```

pivot_longer()




```
data %>%
  pivot_longer(cols, names_to = "A", values_to = "B")
```

pivot_longer()




```
data %>%
  pivot_longer(cols, names_to = "A", values_to = "B")
```

Example: Let's recreate the sitka data from a wide table

```
> head(sitka_wide)
  tree treat t152 t174 t201 t227 t258
1    1 ozone 4.51 4.98 5.41 5.90 6.15
2    2 ozone 4.24 4.20 4.68 4.92 4.96
3    3 ozone 3.98 4.36 4.79 4.99 5.03
4    4 ozone 4.36 4.77 5.10 5.30 5.36
5    5 ozone 4.34 4.95 5.42 5.97 6.28
6    6 ozone 4.59 5.08 5.36 5.76 6.00
```

Example: Let's recreate the sitka data from a wide table

```
> head(sitka_wide)
  tree treat t152 t174 t201 t227 t258
1    1 ozone 4.51 4.98 5.41 5.90 6.15
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4    4 ozone 4.36 4.77 5.10 5.30 5.36
5    5 ozone 4.34 4.95 5.42 5.97 6.28
6    6 ozone 4.59 5.08 5.36 5.76 6.00
```
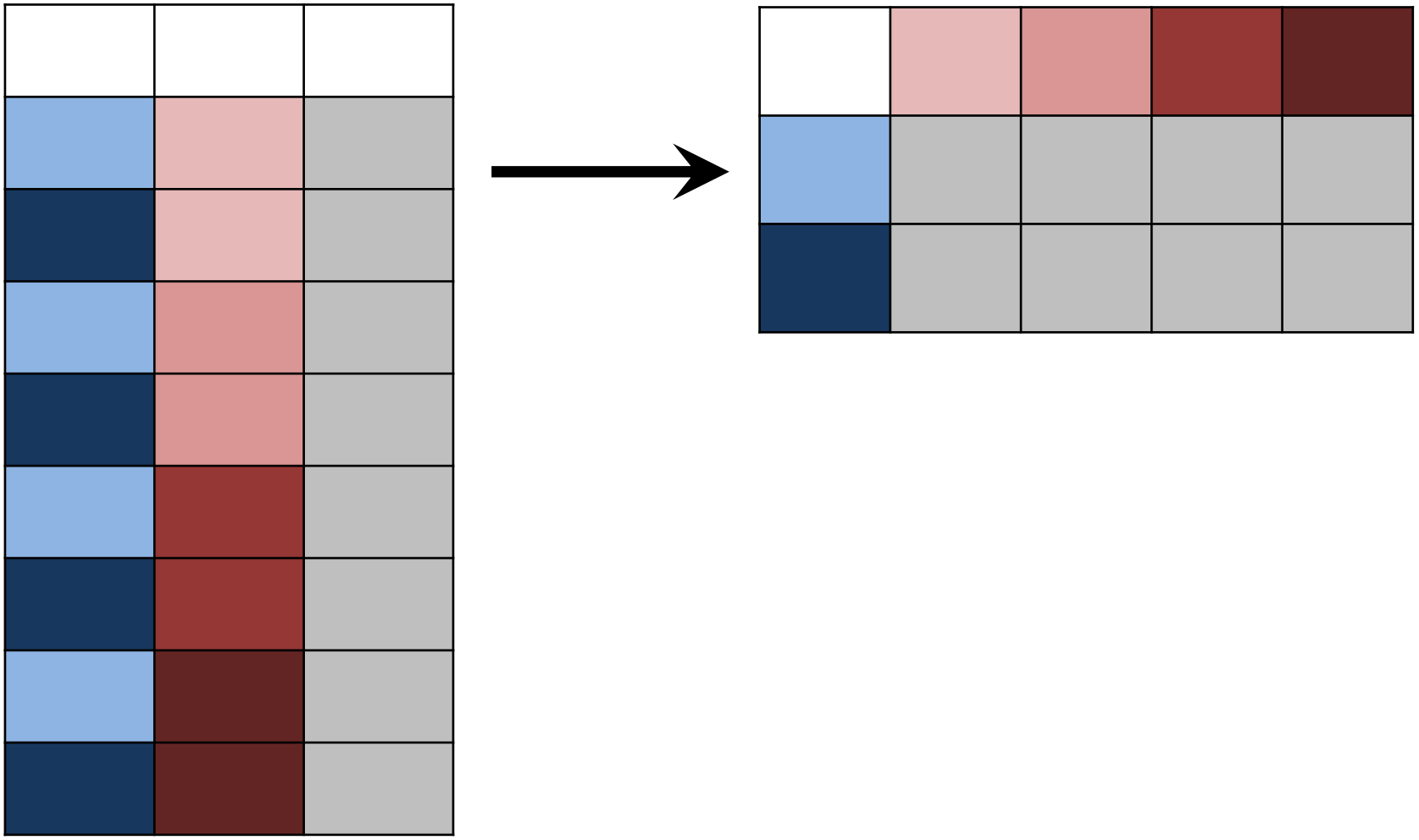

```
sitka_wide %>%
  pivot_longer(
    t152:t258, names_to = "time", values_to = "size"
  )
```

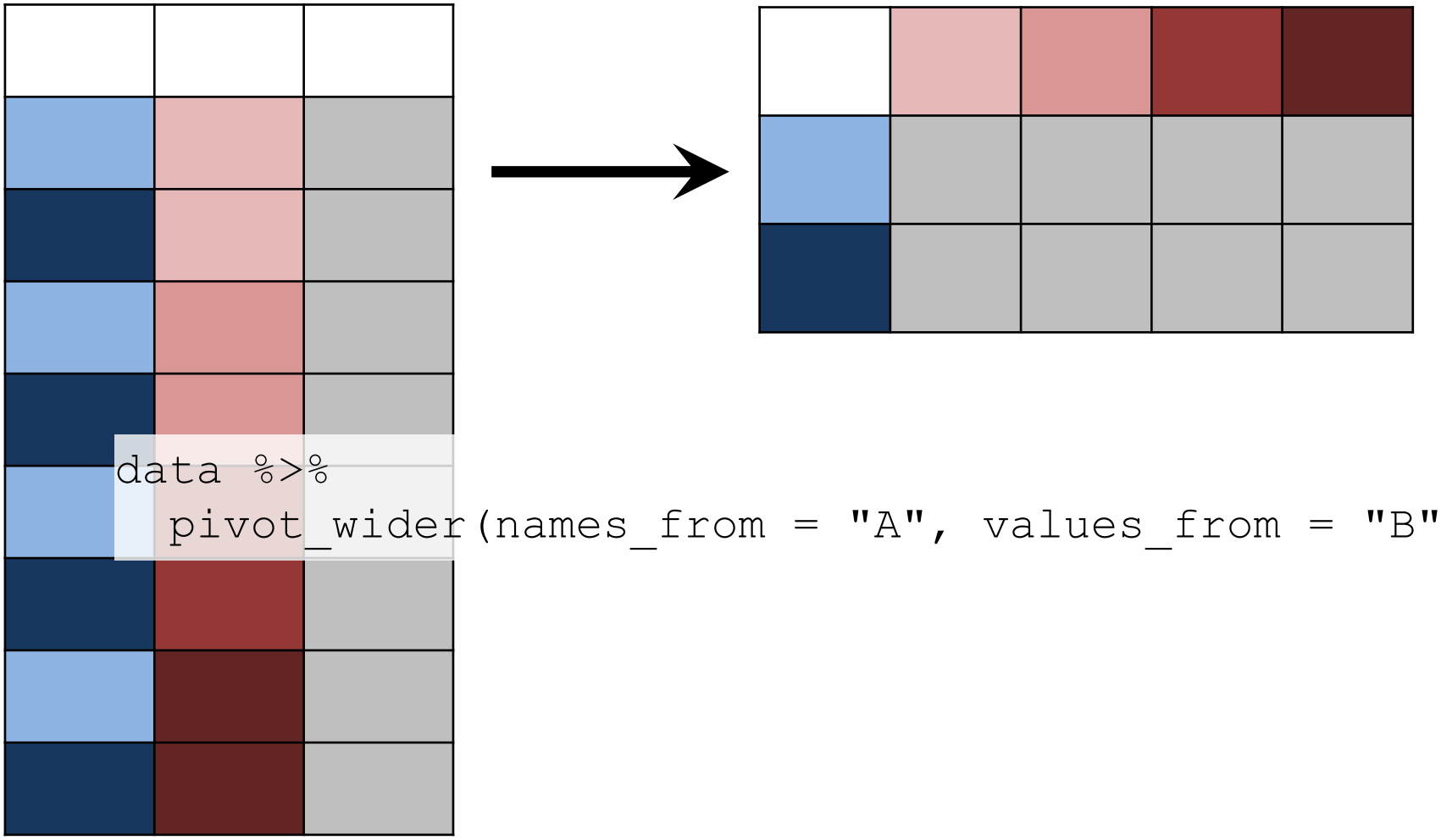
Example: Let's recreate the sitka data from a wide table

```
> sitka_wide %>%
  pivot_longer(
    t152:t258, names_to = "time", values_to = "size"
  )
# A tibble: 395 x 4
    tree treat time   size
   <int> <fct> <chr> <dbl>
 1     1 ozone t152   4.51
 2     1 ozone t174   4.98
 3     1 ozone t201   5.41
 4     1 ozone t227   5.9
 5     1 ozone t258   6.15
 6     2 ozone t152   4.24
 7     2 ozone t174   4.2
 8     2 ozone t201   4.68
 9     2 ozone t227   4.92
10     2 ozone t258   4.96
```

pivot_wider()

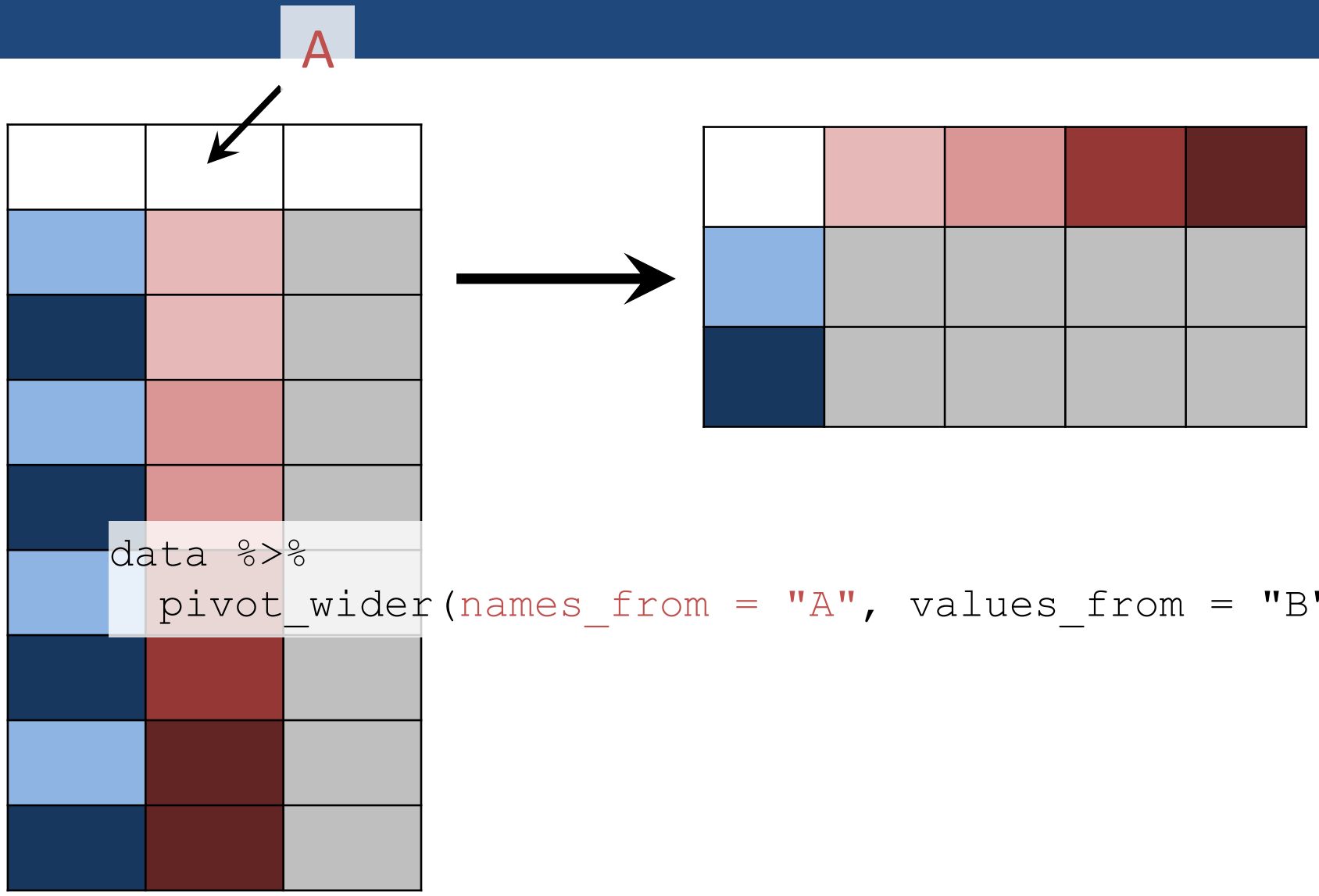


pivot_wider()



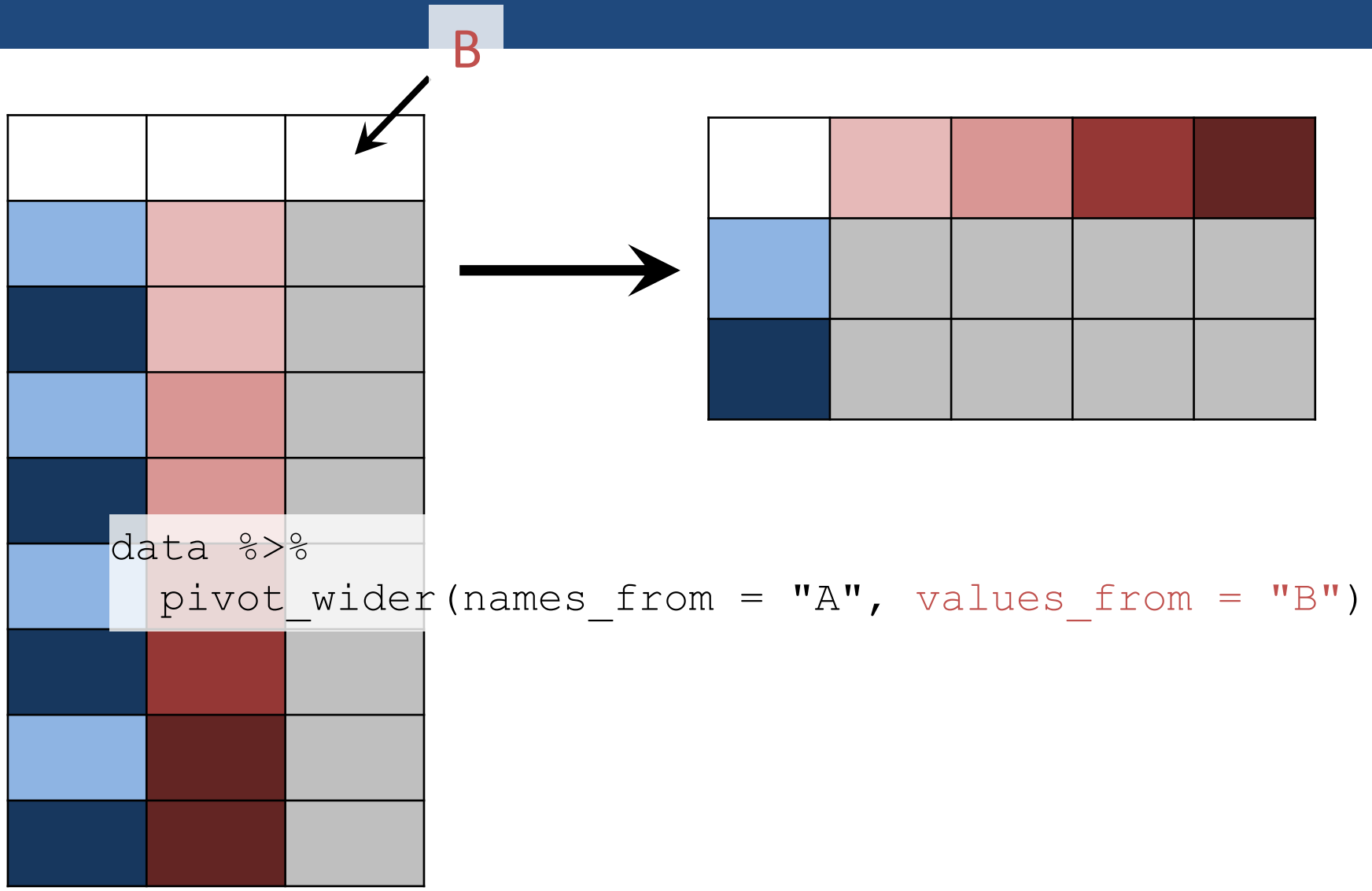
```
data %>%
  pivot_wider(names_from = "A", values_from = "B")
```

pivot_wider()




```
data %>%
  pivot_wider(names_from = "A", values_from = "B")
```

pivot_wider()




```
data %>%
  pivot_wider(names_from = "A", values_from = "B")
```

Example: Let's turn the sitka data into a wide table

```
> head(sitka)
   size Time tree treat
1 4.51   152    1 ozone
2 4.98   174    1 ozone
3 5.41   201    1 ozone
4 5.90   227    1 ozone
5 6.15   258    1 ozone
6 4.24   152    2 ozone
```

```
sitka %>%
  pivot_wider(names_from="Time", values_from="size")
```

Example: Let's turn the Sitka data into a wide table

```
> sitka %>%
  pivot_wider(names_from="Time", values_from="size")

# A tibble: 79 x 7
    tree treat `152` `174` `201` `227` `258`
   <int> <fct> <dbl> <dbl> <dbl> <dbl> <dbl>
 1     1 ozone  4.51  4.98  5.41  5.9   6.15
 2     2 ozone  4.24  4.2   4.68  4.92  4.96
 3     3 ozone  3.98  4.36  4.79  4.99  5.03
 4     4 ozone  4.36  4.77  5.1   5.3   5.36
 5     5 ozone  4.34  4.95  5.42  5.97  6.28
 6     6 ozone  4.59  5.08  5.36  5.76  6
 7     7 ozone  4.41  4.56  4.95  5.23  5.33
 8     8 ozone  4.24  4.64  4.95  5.38  5.48
 9     9 ozone  4.82  5.17  5.76  6.12  6.24
10    10 ozone  3.84  4.17  4.67  4.67  4.8
# … with 69 more rows
```

Working with tidy data in R: tidyverse

Fundamental actions on data tables:

- make new columns — `mutate()`
- combine tables, adding columns — `left_join()`
- combine tables, adding rows — `bind_rows()`
- choose rows — `filter()`
- choose columns — `select()`
- arrange rows — `arrange()`
- calculate summary statistics — `summarize()`
- work on groups of data — `group_by()`