Lab 03: CS631

Working with Data

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Data for today

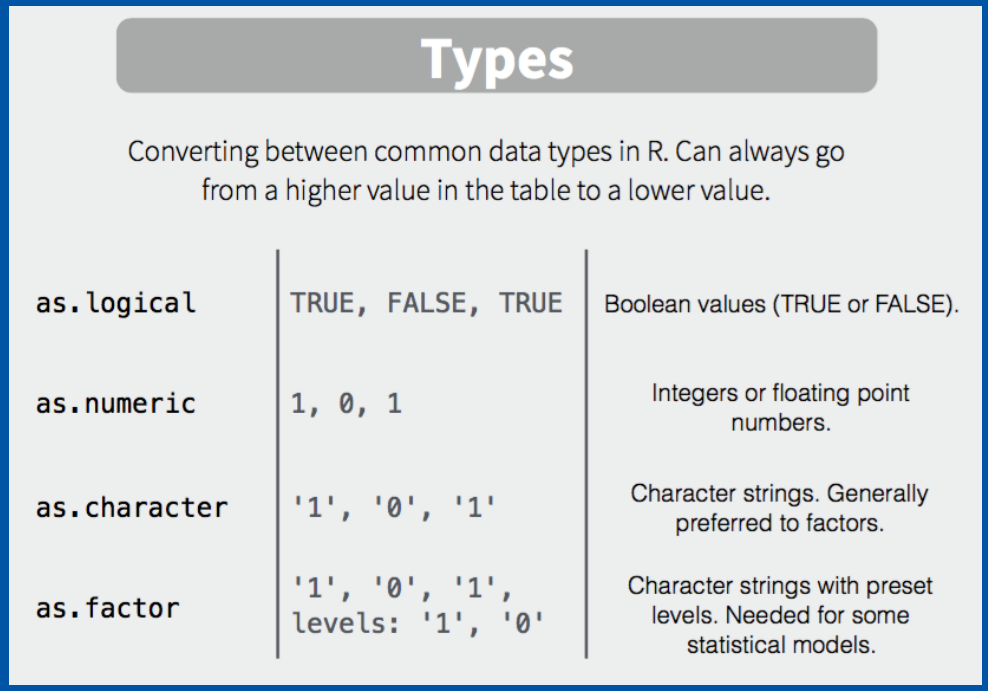
We'll use data from Wordbank- an open source database of children's vocabulary development. The tool used to measure children's language and communicative development in this database is the MacArthur-Bates Communicative Development Inventories (MB-CDI). The MB-CDI is a parent-reported questionnaire.

- R package `wordbankr`
- `wordbankr` vignette
- More about Wordbank
- More about MB-CDI

Get the data

Use this code chunk to import my cleaned CSV file:

```
library(readr)
sounds ← read_csv("http://bit.ly/cs631-meow")
```



Types

Converting between common data types in R. Can always go from a higher value in the table to a lower value.

as.logical	TRUE, FALSE, TRUE	Boolean values (TRUE or FALSE).
as.numeric	1, 0, 1	Integers or floating point numbers.
as.character	'1', '0', '1'	Character strings. Generally preferred to factors.
as.factor	'1', '0', '1', levels: '1', '0'	Character strings with preset levels. Needed for some statistical models.

RStudio Base R Cheatsheet

https://github.com/rstudio/cheatsheets/blob/master/base-r.pdf

Know your data types

- Numeric (2 subtypes)
  - Integers (`1, 50`)
  - Double (`1.5, 50.25`, `?double`)
- Character (`"hello"`)
- Factor (`grade = "A" | grade = "B"`)
- Logical (`TRUE | FALSE`)

```
typeof(sounds$age)
```

```
[1] "double"
```

```
typeof(sounds$sound)
```

```
[1] "character"
```

```
typeof(sounds$sound == "meow")
```

```
[1] "logical"
```

Even better: `glimpse`

```
glimpse(sounds)
```

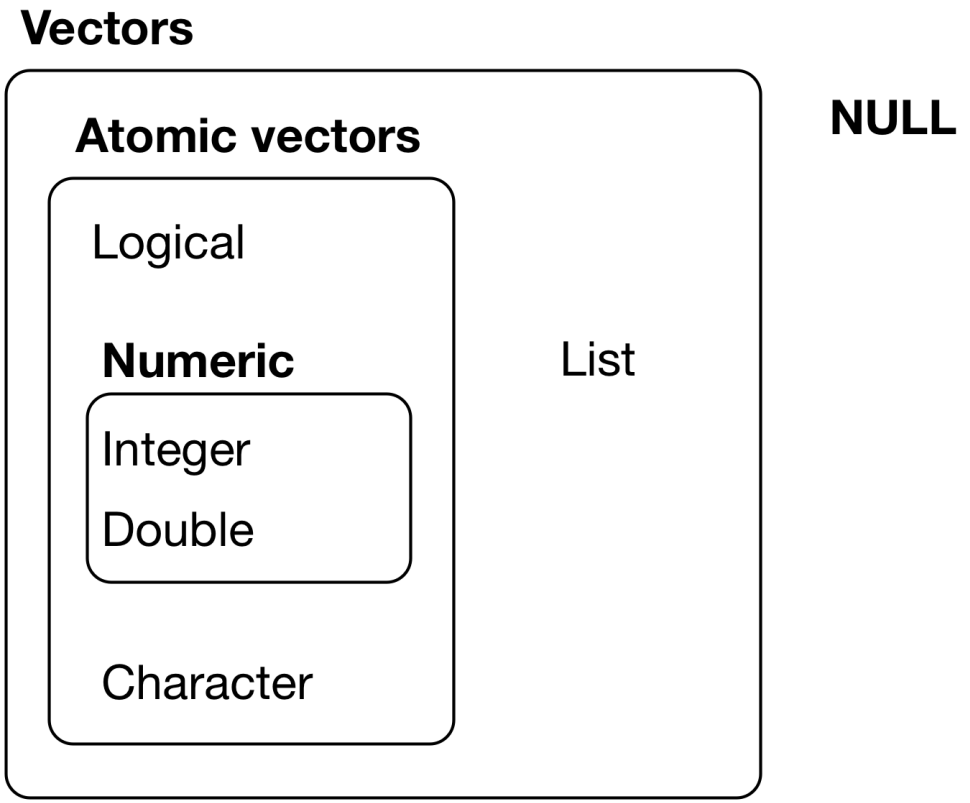
```
Observations: 33
Variables: 4
$ age          <dbl> 8, 8, 8, 9, 9, 9, 10, 10, 10, 11, 11, 11, 12, 12, 12,
$ sound        <chr> "cockadoodledoo", "meow", "woof woof", "cockadoodledoo
$ kids_produce <dbl> 1, 0, 3, 0, 2, 2, 0, 5, 4, 0, 5, 12, 0, 12, 28, 9, 125
$ kids_respond <dbl> 35, 35, 35, 91, 93, 93, 139, 145, 143, 94, 94, 94, 141
```

`sounds` (a subset)

- `age`: child age in months
- `sound`: a string describing a type of animal sound
- `kids_produce`: the number of parents who answered "yes, my child produces this animal sound"
- `kids_respond`: the number of parents who responded to this question at all

age	sound	kids_produce	kids_respond
8	cockadoodledoo	1	35
8	meow	0	35
8	woof woof	3	35
9	cockadoodledoo	0	91
9	meow	2	93
9	woof woof	2	93

Data types


Vectors
Atomic vectors
Logical
Numeric
Integer
Double
Character
List
NULL

Let's review

Data wrangling with `dplyr`

From DataCamp Chapter 3

- `group_by`
- `summarize`

Adding onto your arsenal of...

- `filter`
- `arrange`
- `mutate`
- `glimpse`
- `distinct`
- `count`
- `tally`
- `pull`
- `top_n`

More on `mutate`

3 ways to `mutate`

1. Create a new variable with a specific value
2. Create a new variable based on other variables
3. Change an existing variable

```
sounds %>%
  mutate(form = "WS")
```

```
# A tibble: 33 x 5
     age sound          kids_produce kids_respond form
   <dbl> <chr>                 <dbl>        <dbl> <chr>
 1     8 cockadoodledoo            1           35 WS
 2     8 meow                      0           35 WS
 3     8 woof woof                 3           35 WS
 4     9 cockadoodledoo            0           91 WS
 5     9 meow                      2           93 WS
 6     9 woof woof                 2           93 WS
 7    10 cockadoodledoo            0          139 WS
 8    10 meow                      5          145 WS
 9    10 woof woof                 4          143 WS
```

3 ways to `mutate`

1. Create a new variable with a specific value
2. Create a new variable based on other variables
3. Change an existing variable

```
sounds %>%
  mutate(prop_produce = kids_produce / kids_respond)
```

```
# A tibble: 33 x 5
     age sound          kids_produce kids_respond prop_produce
   <dbl> <chr>                 <dbl>        <dbl>        <dbl>
 1     8 cockadoodledoo            1           35       0.0286
 2     8 meow                      0           35       0
 3     8 woof woof                 3           35       0.0857
 4     9 cockadoodledoo            0           91       0
 5     9 meow                      2           93       0.0215
 6     9 woof woof                 2           93       0.0215
 7    10 cockadoodledoo            0          139       0
 8    10 meow                      5          145       0.0345
 9    10 woof woof                 4          143       0.0280
```

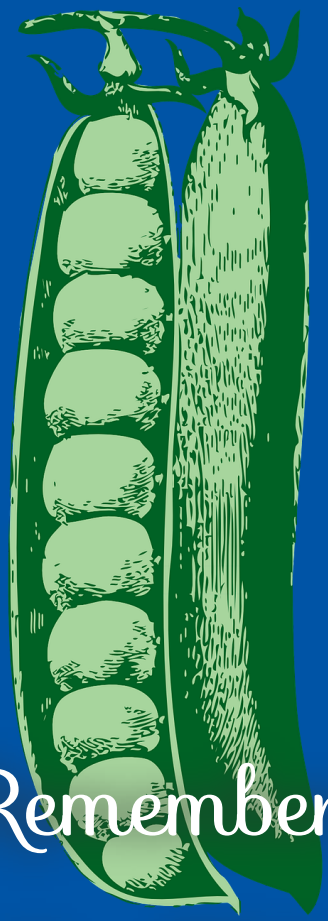
3 ways to `mutate`

1. Create a new variable with a specific value
2. Create a new variable based on other variables
3. Change an existing variable

```
sounds %>%
  mutate(prop_produce = prop_produce * 100)
```

```
# A tibble: 33 x 5
     age sound          kids_produce kids_respond prop_produce
   <dbl> <chr>                 <dbl>        <dbl>        <dbl>
 1     8 cockadoodledoo            1           35         2.86
 2     8 meow                      0           35         0
 3     8 woof woof                 3           35         8.57
 4     9 cockadoodledoo            0           91         0
 5     9 meow                      2           93         2.15
 6     9 woof woof                 2           93         2.15
 7    10 cockadoodledoo            0          139         0
 8    10 meow                      5          145         3.45
 9    10 woof woof                 4          143         2.80
```

Let's review some helpful functions for `mutate` + `summarize`



Remember:

Base R + Tidyverse

First:

Arithmetic

especially useful for `mutate`

See:

http://r4ds.had.co.nz/transform.html#mutate-funs

```
?Arithmetic
```

Operator	Description	Usage
+	addition	x + y
-	subtraction	x - y
*	multiplication	x * y
/	division	x / y
^	raised to the power of	x ^ y
abs	absolute value	abs(x)
%/%	integer division	x %/% y
%%	remainder after division	x %% y

```
5 %/% 2 # 2 goes into 5 two times with ...
```

```
[1] 2
```

```
5 %% 2 # 1 left over
```

```
[1] 1
```

Second:

Summaries

especially useful for `summarize`

even more useful after a `group_by`

See:

http://r4ds.had.co.nz/transform.html#summarise-funs

Description	Usage
sum	sum(x)
minimum	min(x)
maximum	max(x)
mean	mean(x)
median	mean(x)
standard deviation	sd(x)
variance	var(x)
rank	rank(x)

- All allow for `na.rm` argument to remove `NA` values before summarizing. The default setting for this argument is *always* `na.rm = FALSE`, so if there is one `NA` value the summary will be `NA`.
- See "Maths Functions" in the RStudio Base R Cheatsheet: https://github.com/rstudio/cheatsheets/blob/master/base-r.pdf

"Spent day pondering grayscale vs colourscale using `ggplot`"

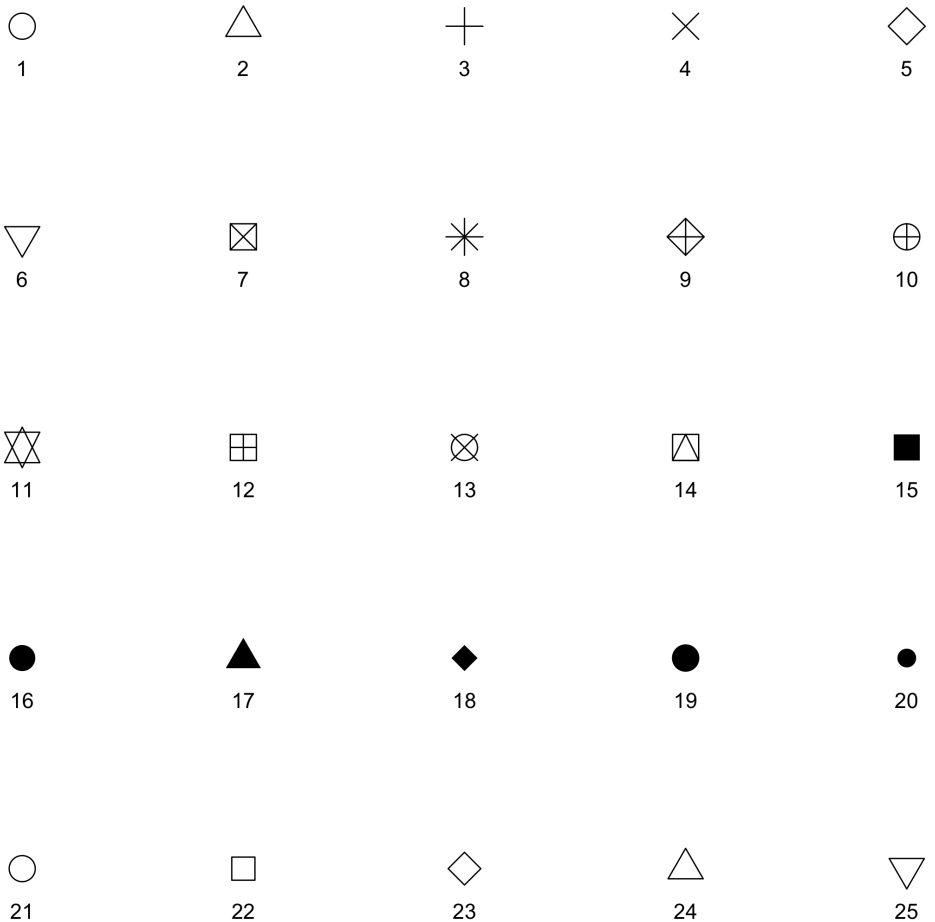
photo and caption courtesy @alice-data

Today's lab: COLORS

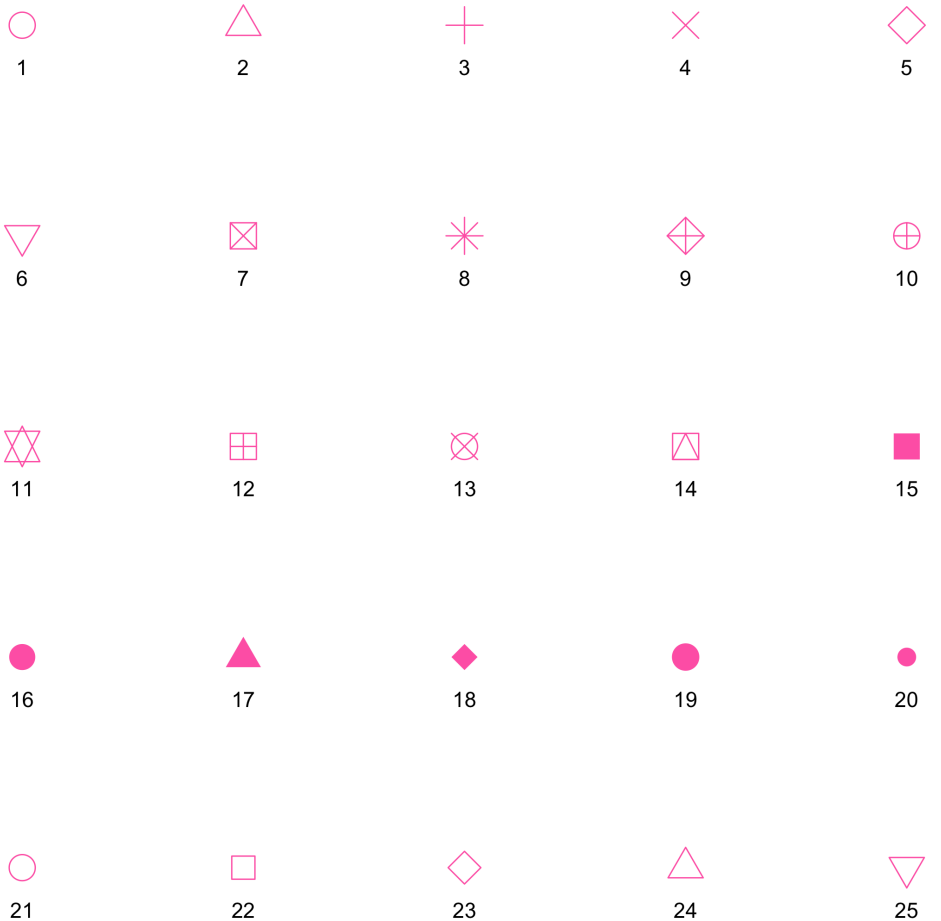
Specifically, discrete colors.

At the end of today's lab, you'll see an extra section on continuous colors.

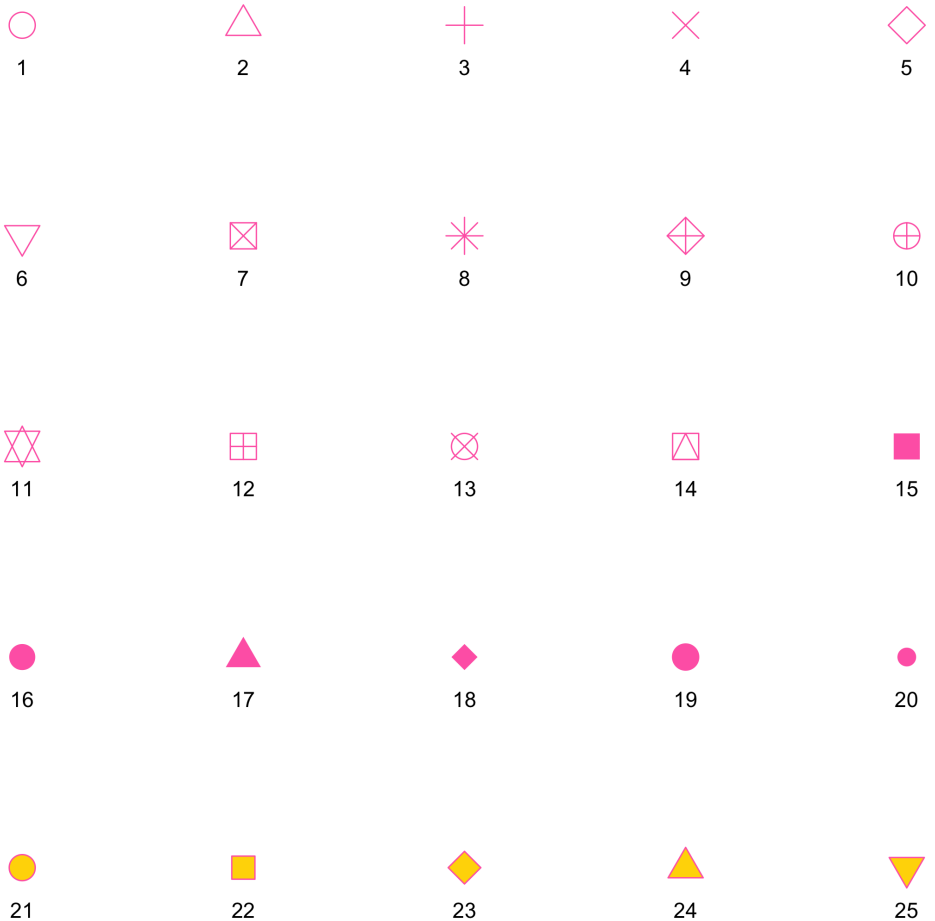
But first: shape



Shapes with `color = "hotpink"`



Shapes with `fill = "gold"`



Default shape for `geom_point`

🕵🏽 Requires spelunking into the dark corners of the `ggplot2` code on GitHub:

```
default_aes = aes(
    shape = 19, colour = "black", size = 1.5, fill = NA,
    alpha = NA, stroke = 0.5
  )
```

So, the default for `geom_point(shape = 19)`! This is important to remember: this shape only "understands" the *color* aesthetic, but not the *fill* aesthetic.

R Markdown:

https://www.markdowntutorial.com

https://andrewbtran.github.io/NICAR/2018/workflow/docs/02-rmarkdown.html

https://yihui.name/tinytex/ *(install!)*

https://github.com/rstudio/cheatsheets/blob/master/rmarkdown-2.0.pdf

https://rmarkdown.rstudio.com/html_document_format.html

https://rmarkdown.rstudio.com/pdf_document_format.html