AAA spline data tidying and plotting

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1 Data import

Before importing the data, we need to specify the column names for the data set header, since the raw data does not have a header. The number of splines `num.splines` can be changed; the default is `42`. `columns` is a factor containing the column names which we will use when we import the data. The column names of the splines coordinates are generated by the `paste0` function, according to the format `X_1, Y_1, X_2, Y_2, X_n, ...` (the underscore `_` will be useful later for separating the axis label from the fan number). You can change or add column names according to the structure of your data.

```
num.splines <- 42
columns <- c(
    "subject",
    "seconds",
    "rec.date",
    "prompt",
    "label",
    "TD.displacement",
    "TT.displacement",
    "TD.displacement.sm",
    "TD.velocity",
    "TD.velocity.abs",
    "TT.displacement.sm",
    "TT.velocity",
    "TT.velocity.abs",
#    ^^^^^ CHANGE ABOVE ^^^^^
    paste0(rep(c("X", "Y"), num.splines),
            "_",
            rep(1:num.splines, each = 2)
            )
)
```

We can now import the spline data (`SC01-aaa.txt`) and the stimuli database (`nonce.csv`).

```
raw.data <- SC01_aaa <- read_delim("./data/SC01-aaa.txt",
    "\t", escape_double = FALSE,
    col_names = columns,
    na = "*",
    trim_ws = TRUE
    )
```

```
## Parsed with column specification:
```

```
## cols(
##   .default = col_double(),
##   subject = col_character(),
##   rec.date = col_character(),
##   prompt = col_character(),
##   label = col_character()
## )
```

```
## See spec(...) for full column specifications.
```

```
rm(num.splines, columns)

raw.data <- unique(raw.data)

stimuli <- read.csv("./data/nonce.csv")
```

The following code applies tidy formatting to the data frame. It uses functions from the `tidyr` library.

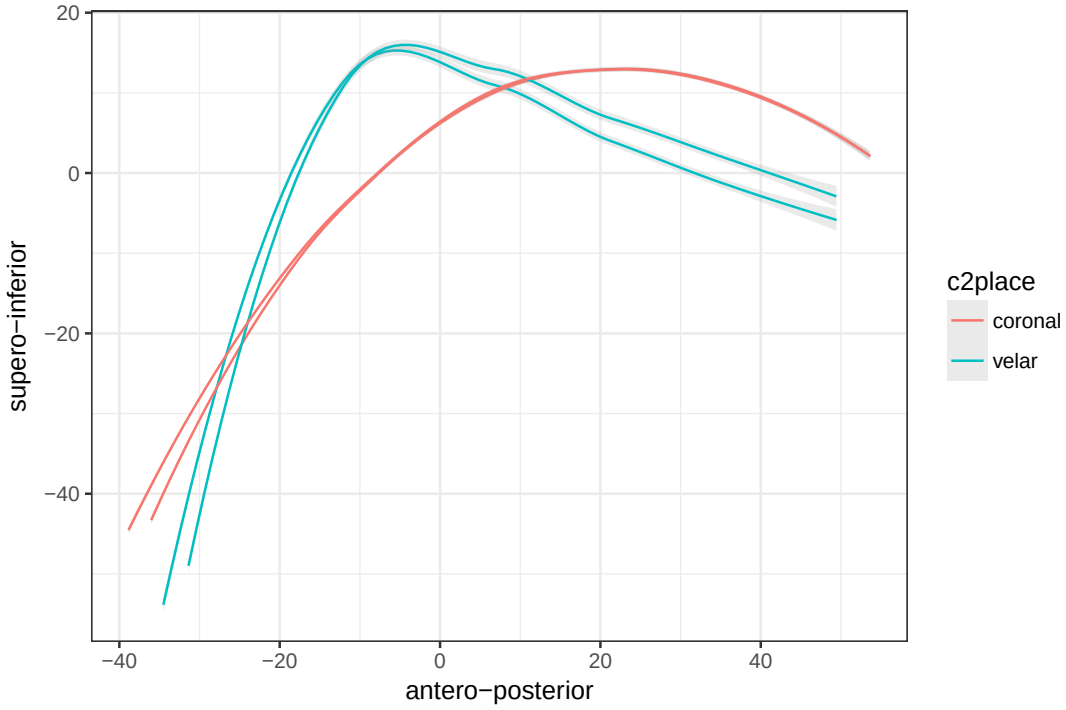
```
splines <- raw.data %>%
    gather(spline, coordinate, matches("[XY]_")) %>%
    separate(spline, c("axis", "fan"), convert = TRUE) %>%
    spread(axis, coordinate) %>%
    mutate(word = as.factor(word(prompt, 2))) %>%
    left_join(y = stimuli, by = c("word" = "orth"))
```

2 Some plotting

We can finally create some plots.

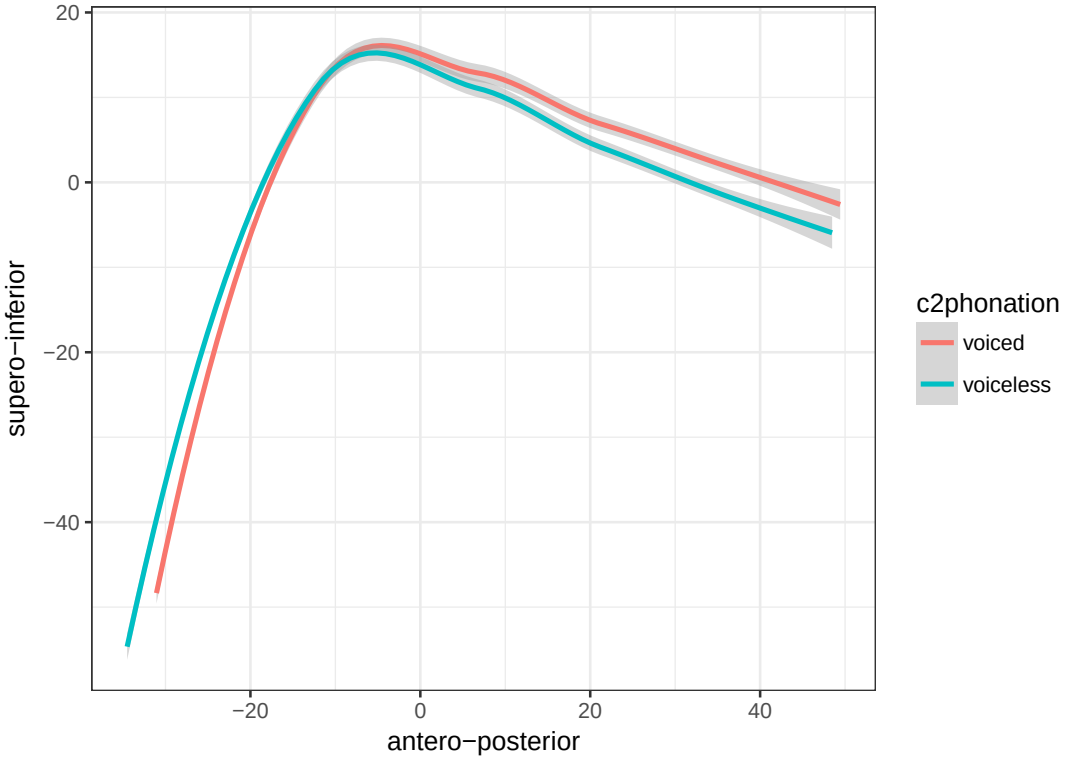
```
ggplot(splines, aes(x = X, y = Y, group = word, colour = c2place)) +
    geom_smooth(size = 0.5, alpha = 0.2) +
    coord_fixed(ratio = 1) +
    xlab("antero-posterior") +
    ylab("supero-inferior")
```

```
## `geom_smooth()` using method = 'loess'
```



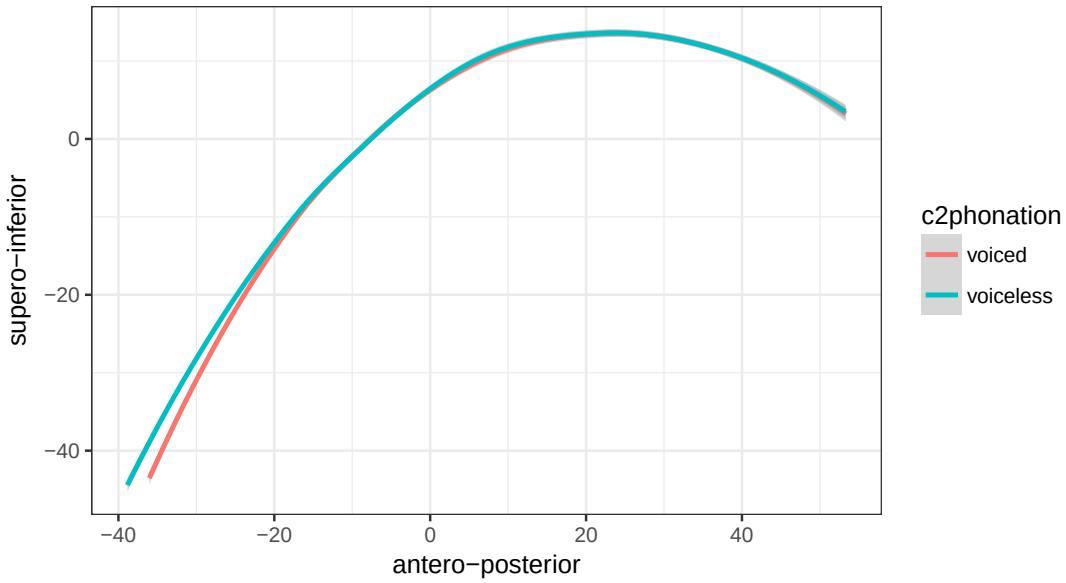
Plot the tongue shape for velar consonants at the moment of maximum constriction.

```
filter(splines, label == "max_TD") %>%
ggplot(aes(x = X, y = Y, colour = c2phonation)) +
    geom_smooth(method = "loess") +
    coord_fixed(ratio = 1) +
    xlab("antero-posterior") +
    ylab("supero-inferior")
```



Plot the tongue shape for coronal consonants at the moment of maximum constriction.

```
filter(splines, label == "max_TT") %>%
ggplot(aes(x = X, y = Y, colour = c2phonation)) +
    geom_smooth(method = "loess") +
    coord_fixed(ratio = 1) +
    xlab("antero-posterior") +
    ylab("supero-inferior")
```



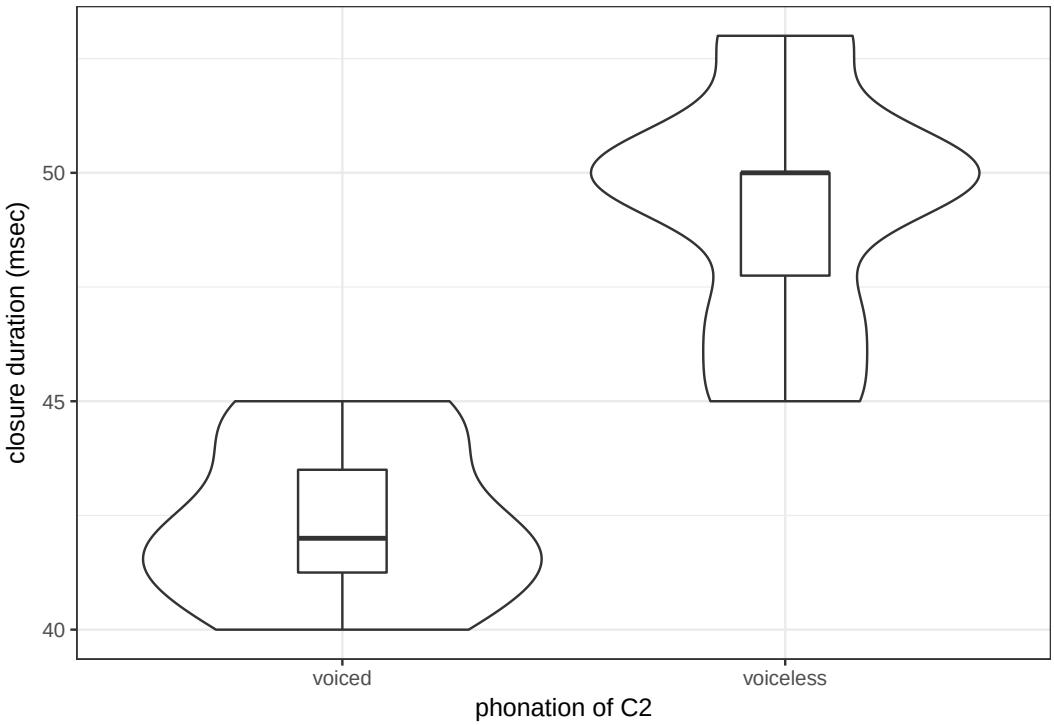
3 Consonantal gestures: target, maximum, release

Now we can create a separate data frame where the observasional unit is each word and the variables are the consonantal getures (target, maximum closure, release).

```
cons.gestures <- raw.data %>%
    select(subject:label) %>%
    separate(label, c("gesture", "tongue.area")) %>%
    spread(gesture, seconds) %>%
    select(subject:tongue.area, target, max, release) %>%
    mutate(closure = (release - target) * 1000) %>%
    mutate(word = as.factor(word(prompt, 2))) %>%
    left_join(y = stimuli, by = c("word" = "orth"))
```

Let's plot closure duration as a function of place of articulation and voicing of C2 (our target consonant in C1VC2V words). Since in the original data the values of the release for velar consonants are missing, we will plot values only from the coronal consonants.

```
filter(cons.gestures, c2place == "coronal") %>%
ggplot(aes(c2phonation, closure)) +
    geom_violin() +
    geom_boxplot(width=0.2) +
    xlab("phonation of C2") +
    ylab("closure duration (msec)")
```


closure duration (msec)
50
45
40
voiced
voiceless
phonation of C2