Overall analysis

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1. Overall kinematic analysis

1.1. Gesture Duration

Fig 1. Overall Gesture Duration

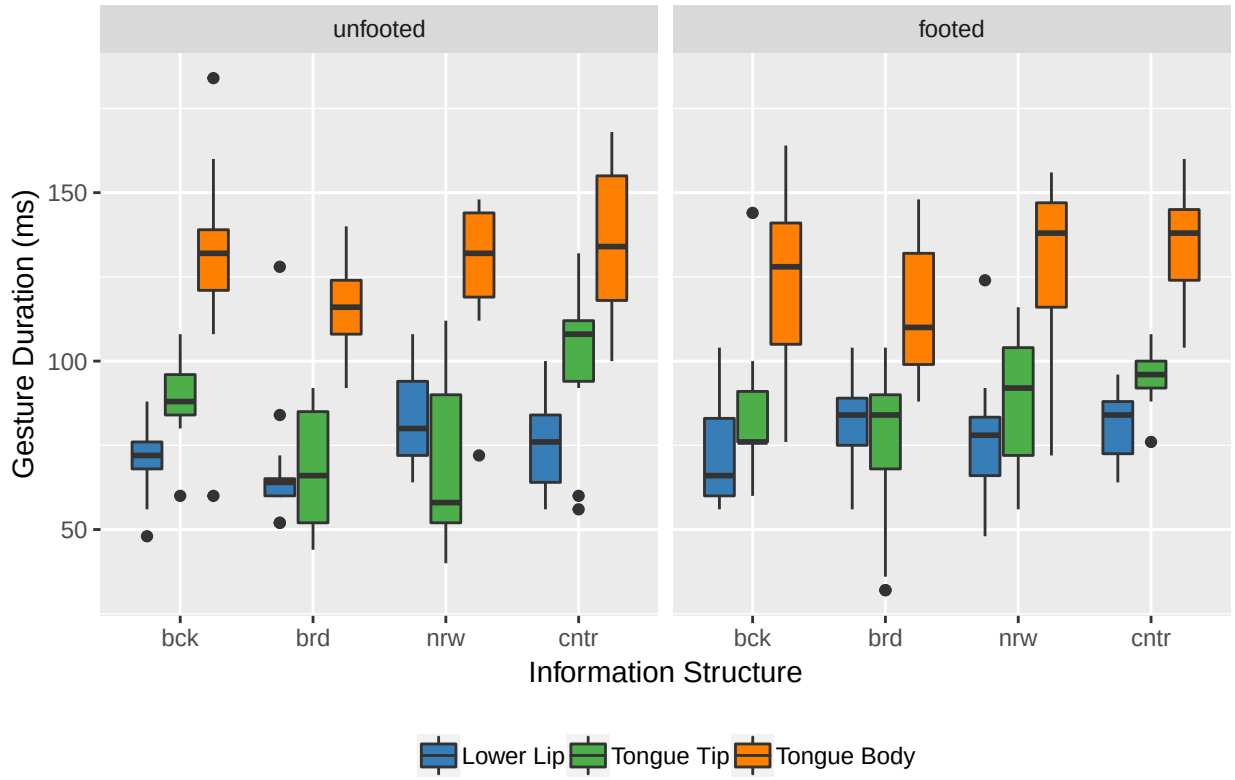


Fig 1. displays the distribution of gesture duration data across 2 speakers in different conditions. I found a main effect of Information Structure on *gesture duration*: F(3, 286) = 8.60 (p < .001). *Across-accentuation*, longer movements were confirmed when comparing the maximally diverging focus structures, i.e., *background* and *contrastive focus*. The duration of opening gesture across the three different articulators increased on average 9.40ms. *Within-accentuation*, opening gestures were averagely 15.7ms longer in *contrastive focus* condition than *background focus* condition.

The main factor *Place of Articulation* also has an effect on *gesture duration* (F(2, 286) = 204.50 (p < .001), post-hoc: /k/ > /t/ > /p/).

The interaction between *place of articulation* and *information_structure* was confirmed significant (F(6, 286) = 2.56, p <. 05). While the greatest increase for *lower lip* is between *contrastive focus* and *background* (6.4ms longer), the largest differences for *tongue tip* and *tongue body* come from comparing *contrastive focus* and *broad focus* (26.2ms and 18ms longer, respectively).

```
## # A tibble: 3 x 5
## # Groups:   Place [3]
```

```
##   Place         bck   brd   nrw  cntr
##   <fct>       <dbl> <dbl> <dbl> <dbl>
## 1 lower_lip    71.4  75.1  79.5  77.8
## 2 tongue_tip   86.7  72    78.9  98.2
## 3 tongue_body 127   116   129.  134.
```

Effects of *Footedness* on *gesture duration* failed to reach the level of significance.

1.2. Maximum Displacement

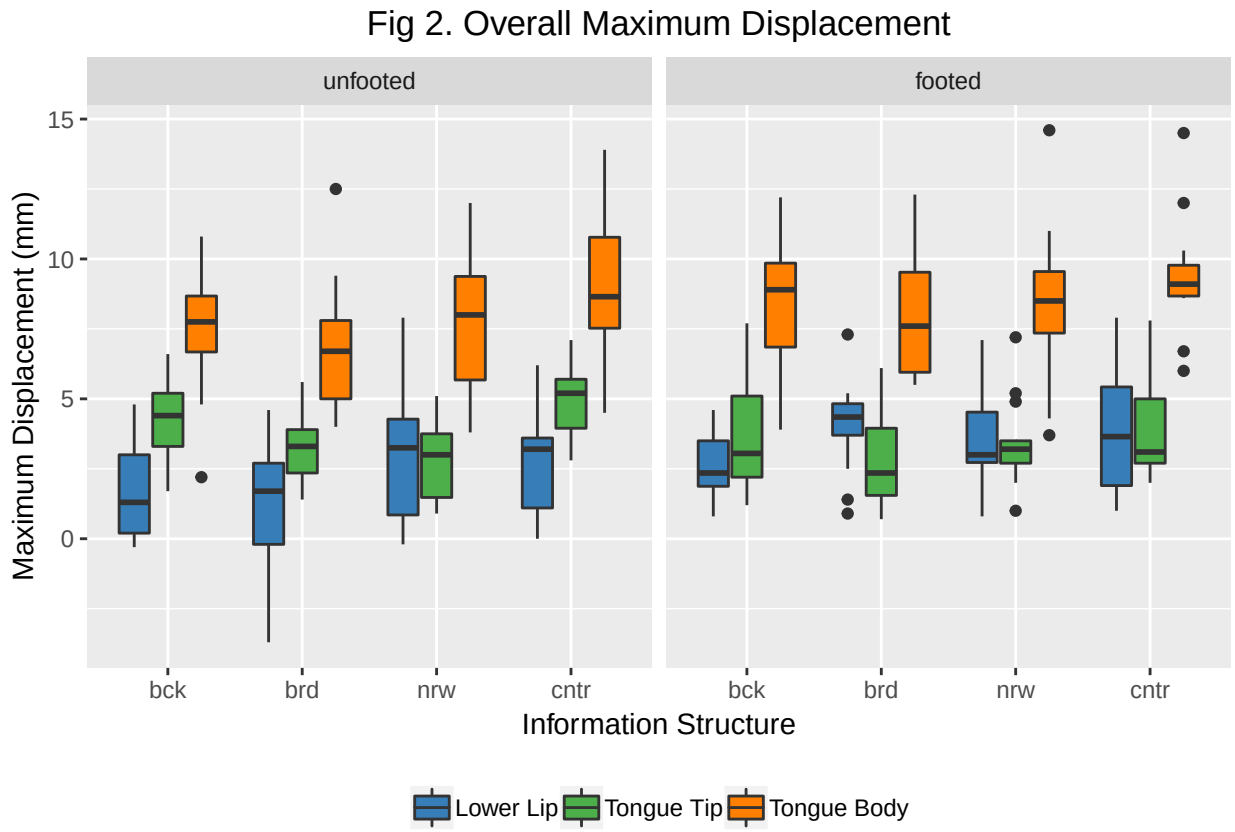


Fig 2. shows the distribution of maximum displacement of the opening gesture in different conditions. I observed larger movements across different *Information structures*: $F(3, 286) = 6.82$ ($p < .001$). *Across-accentuation*, the opening gestures are averagely 1.14mm larger in *contrastive focus* than in *background*. *Within-accentuation*, the displacement of gestures increased from *broad focus* to *contrastive focus* for an average of 1.37mm, from *narrow focus* to *contrastive focus* for an average of 0.85mm.

Place of articulation again has an effect on displacement ($F(2, 286) = 208.58$ ($p < .001$), post-hoc: /k/ > /t/ > /p/).

Comparing the two *footedness* condition, the movement under footed conditions overall is 0.48mm larger than unfooted conditions ($F(1, 286) = 4.36$ ($p < .05$)).

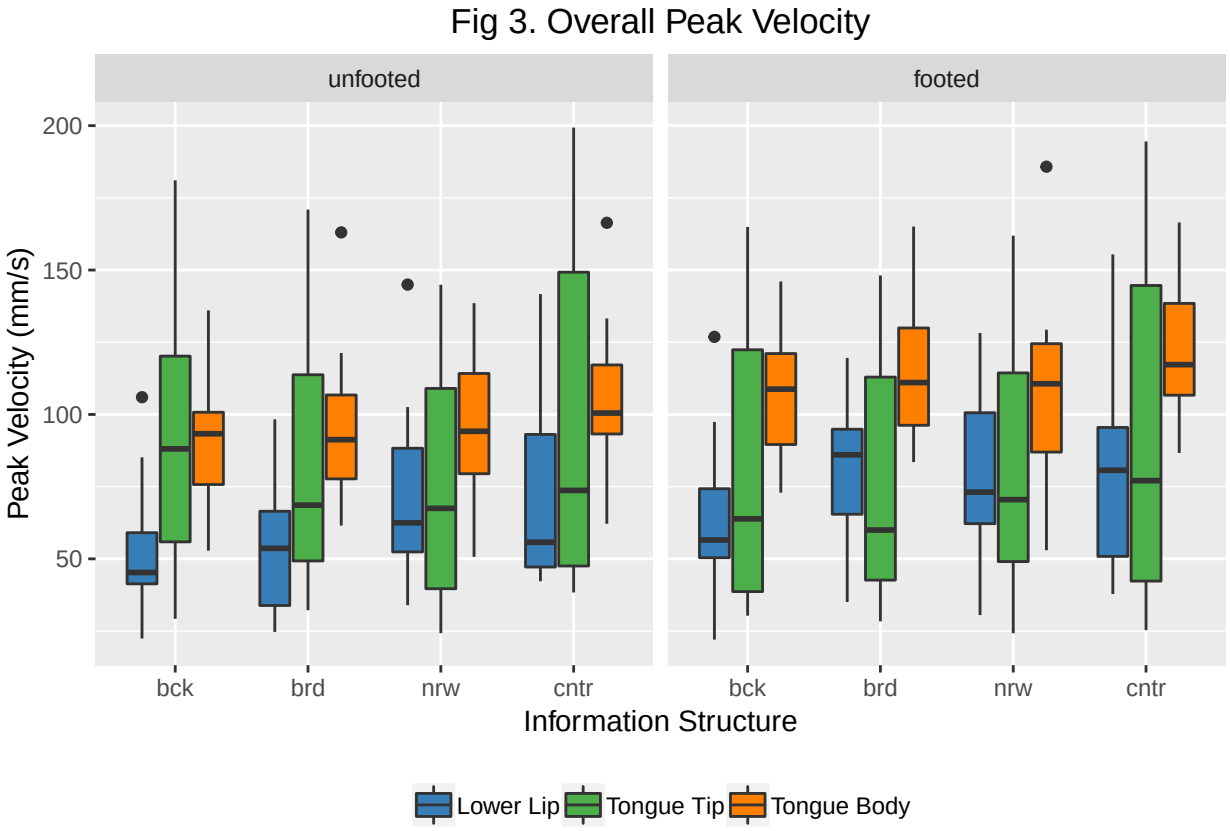
The interaction of *place* and *footedness* reached the level of significance ($F(2, 286) = 5.075$ ($p < .01$)).

```
## # A tibble: 2 x 4
## # Groups:   Footedness [2]
##   Footedness lower_lip tongue_tip tongue_body
##   <fct>          <dbl>      <dbl>       <dbl>
## 1 unfooted        2.15       3.81        7.84
```

```
## 2 footed          3.53        3.44         8.46
```

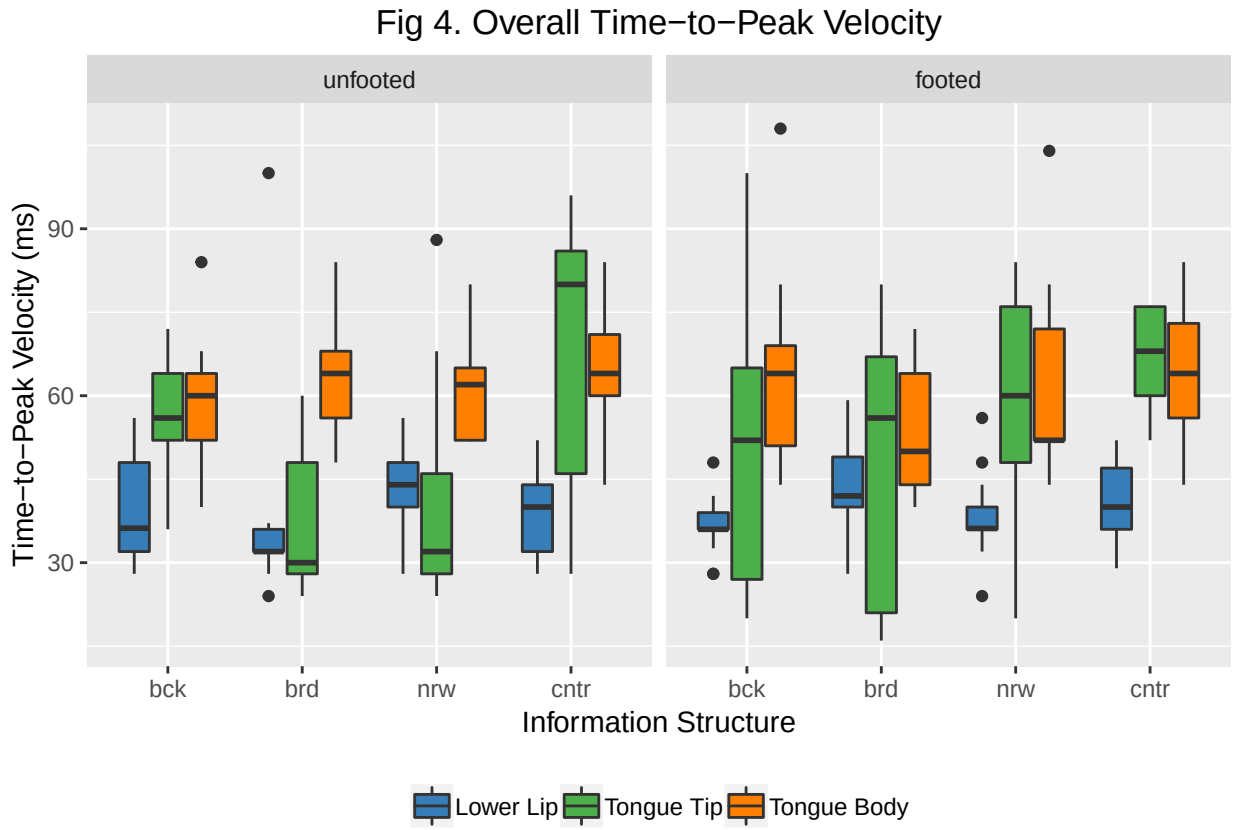
As can be seen from the table, whereas for *lower lip* and *tongue body*, the articulators moved larger from unfooted condition to footed condition, *tongue tip* moved smaller.

1.3. Peak Velocity



No significant differeces due to *information structure* was confirmed but it was statistically close ($F(3, 286) = 2.26$, $p < .1$). On the other hand, *footedness* ($F(1, 286) = 4.09$ ($p < .05$); post-hoc: 8.23mm/s faster when footed than unfooted) and *place of articulation* ($F(2, 286) = 25.1498$ ($p < .05$); post-hoc: /k/ > /t/ > /p/) both have a main effect on how fast the articulators move. Interactions between the three variables were not significant for peak velocity.

1.4. Time-to-Peak Velocity



An effect of *Information structureand* on *time-to-peak velocity* was observed ($F(3, 286) = 6.12$ ($p < .05$)). *Across-accentuatoin*, there is a less stiff movement comparing *contrastive focus* to *background* (6.34ms later). *Within-accentuation* time-to-peak velocity is 9.83ms later in *contrastive focus* than in *broad focus*. Though not significant, the difference between contrastive focus and narrow focus of 5.78ms is just above significant level (p-adjusted = 0.06).

The *place of articulation* again is significant ($F(2, 286) = 59.41$ ($p < .05$); post-hoc: /k/ > /t/ > /p/).

There was also an interaction between *place of articulation* and *information structure* ($F(6, 286) = 3.34$, $p < .01$). The greatest modification in articulation for lower lip comes from comparing narrow and background context (2.3ms later in narrow focus), while for tongue tip and tongue body, the greatest increase was found in comparing contrastive and broad focus (23.9ms and 12.9ms respectively).

```
## # A tibble: 4 x 4
##   Info_str lower_lip tongue_tip tongue_body
##   <fct>        <dbl>      <dbl>       <dbl>
## 1 bck           37.9       53.0        61.8
## 2 brd           40.5       42.8        57.9
## 3 nrw           41.2       51.2        61.5
## 4 cntr          40.5       66.7        64.8
```

2. By-speaker analysis

There is a huge inter-speaker variation observed from the data. A series of two-way ANOVAs taking *information structure* and *footedness* as the independent variables was run by each speaker for each kinematic

measurement. The table below summarises the result of the analysis by speakers.

to be continued...