Hypothesis: Critical articulators and non-critical articulators are weighted differently for achieving distinctive emotional goals on top of linguistic goals at the same time. Speakers may use the variability of non-critical articulators more than critical articulators for achieving non-linguistic goals, like emotion encoding.

Analysis List:
1. How much emotional information is contained in the movements of critical articulators and non-critical articulators? Which has more?
2. How differently are the articulatory kinematics of critical articulators and non-critical articulators correlated with emotion?
3. What is the variability of critical articulators and non-critical articulators associated with distinctive emotion encoding?

Electromagnetic Articulography database
- 5 acted emotions, 1 male (SB) + 2 females (JN, JR)
- Unit of segments: syllable (CVC)
  - Same critical articulator for the two consonants. Ex) [pi y p], [f a v v], [t a y t], [n a y t]
  - 38 parameters: position, speed, acceleration at 5 landmark (LM) points, statistics of articulatory movements in LM-based regions
  - 5 landmark points

ANOVA for analysis (2)
- Overall characteristics of articulatory kinematics of articulatory trajectory of critical articulators are emotionally significant.
  - Mostly significant for five categorical emotions
  - However, average positions of critical articulators in the horizontal and vertical axes tend to be less significant or not significant (p > 0.05).
  - Significance of non-critical articulators tend to be higher than that of critical articulators.

Position $\{x, z\}$, speed and acceleration at each LM
- Vertical positions at LM 4 and LM 5 (approaching region) tend to be less significant.
  - Tangential speed and acceleration are mostly significant at LM 2 and LM 4.
  - Almost all lip parameters are significant. They tend to be more significant than those of tongue tip's in general.
  - Position parameters are most significant at the largest opening point (LM 3).
  - Tangential speed and acceleration are most significant at the maximum speed points in releasing and approaching regions.

Distribution plots for analysis (3)
- Sample distribution plots (2o ellipsoid) for emotions
  - Releasing (LM 1 ~ LM 3) and approaching (LM 3 ~ LM 5)

Conclusions & future work
- Distinctive emotional information: NCA > CA for TT. (? for lips)
- More universal emotional encoding patterns of NCA than CA
- Variation of articulatory positions in a syllable (CVC) region follows the property of emotion in the arousal dimension
- Future works:
  - Articulatory target for linguistic goals: region or contour?
  - Inter-speaker comparison, phase, etc.