

# sentence\_articulation

June 7, 2017

## 1 Sentence Articulation

### 1.1 Load Sentence

```
In [26]: import timit_stats as ts
import gesture as ges
import os
import matplotlib.pyplot as plt

%pylab inline

root_dir = "../USC-TIMIT/EMA/Data/M1"
index = 0

t_names, m_names = zip(*ts.list_TIMIT_dir(root_dir))
trans_fname = t_names[index]
mat_fname = m_names[index]

# parse .trans file
t_starts, t_ends, phonemes, words, sentences = ts.parse_transcription(trans_fname)
phones = list(set(phonemes))
# parse .mat file
params, srates = ts.parse_mat(mat_fname)
print "Sentence \"{}\" loaded succesfully".format(trans_fname)
```

Populating the interactive namespace from numpy and matplotlib  
Sentence "../USC-TIMIT/EMA/Data/M1/trans/usctimit\_ema\_m1\_001\_005.trans" loaded succesfully

WARNING: pylab import has clobbered these variables: ['colors']  
`%matplotlib` prevents importing \* from pylab and numpy

### 1.2 Plot Sentence Phonemes

```
In [42]: import matplotlib.patches as patches

cmap = plt.get_cmap('Set3')
```

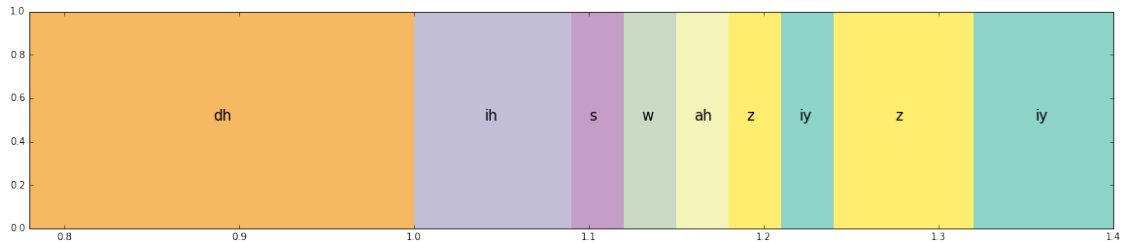
```

colors = [cmap(i) for i in np.linspace(0, 1, len(phones))]
colors = dict(zip(phones, colors))

# show first 20 phonemes except first one ("silence")
num_to_show = min(len(phonemes), 10)

fig1, ax1 = plt.subplots(figsize=(20, 4))
ax1.set_xlim(t_ends[0], t_ends[num_to_show-1])
ax1.set_ylim(0, 1.0)
for i in range(1, num_to_show):
    width = t_ends[i]-t_starts[i]
    height = 1.0
    ax1.add_patch(patches.Rectangle((t_starts[i], 0.0),
                                    width, height, color=colors[phonemes[i]]))
    ax1.text(t_starts[i]+width/2-0.005, height/2, phonemes[i], fontsize=15)
plt.show()

```



### 1.3 Calc Gestures And Variances

```

In [68]: gestures = {}
means = {} # key : param_name, value: dict(ges, val)
variances = {} # key : param_name, value: dict(ges, val)

articulators = ["LL", "UL", "TT", "TB", "TD", "JAW"]
domains=["_x", "_y"]
param_names = [a+d for a in articulators for d in domains]

for i in range(len(t_names)):
    t_fname = t_names[i]
    mat_fname = m_names[i]
    gest = ts.calc_gestures(mat_fname, t_fname)
    for g in gest:
        if g not in gestures:
            gestures[g] = ges.Gesture(g)
            gestures[g].extend(gest[g])
print "gestures calculation finished"

```

```

for p in param_names:
    means[p] = {}
    variances[p] = {}

for g in gestures:
    g_m = gestures[g].get_mean()
    g_v = gestures[g].get_variance()
    for p in param_names:
        means[p][g] = g_m[p]
        variances[p][g] = g_v[p]

print "Means and variances calculated succesfully"

```

gestures calculation finished  
Means and variances calculated succesfully

## 1.4 Plot Articulators

In [92]: `import copy`

```

cmap = plt.get_cmap('gist_heat')
colors = [cmap(i) for i in range(100)]
colors = list(reversed(colors))

for p in param_names:
    # get min and max variance for p
    v_min = min(variances[p].itervalues())
    v_max = max(variances[p].itervalues())
    v_range = v_max - v_min
    # prepare figure
    fig1, ax = plt.subplots(figsize=(20, 4))
    fig1.suptitle("Parameter \"{0}\"".format(p),
                  fontsize=20, fontweight='bold')
    ax.grid(color='black', linestyle='--', linewidth=1, alpha=0.3, axis='y')
    ax.set_xlabel("time, (sec)")
    ax.set_ylabel("position, (mm)")
    # calc range
    ax.set_xlim(t_ends[0], t_ends[num_to_show-1])

    rate = srates[p]
    i_start = int(t_ends[0] * rate)
    i_end = int(t_ends[num_to_show-1] * rate)
    length = i_end - i_start
    y = params[p][i_start:i_end]
    p_min = min(y)-0.5
    p_max = max(y)+0.5
    ax.set_ylim(p_min, p_max)

```

```

height = p_max - p_min

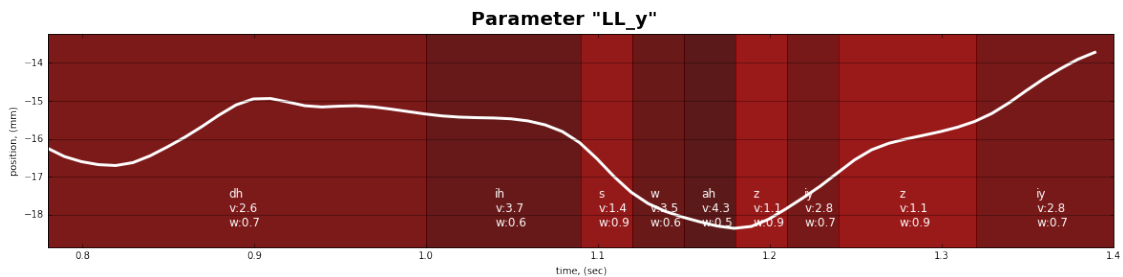
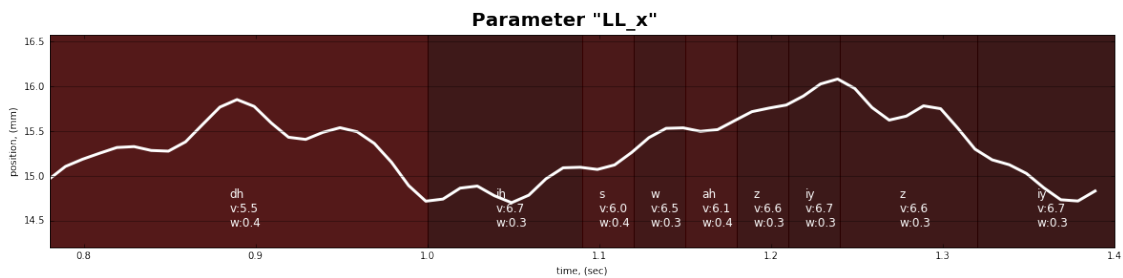
for i in range(1, num_to_show):
    phone = phonemes[i]
    v = variances[p][phone]
    w = 1 - (v-v_min)/(v_max-v_min)
    clr = colors[int((v-v_min)/(v_max-v_min)*100)-1]

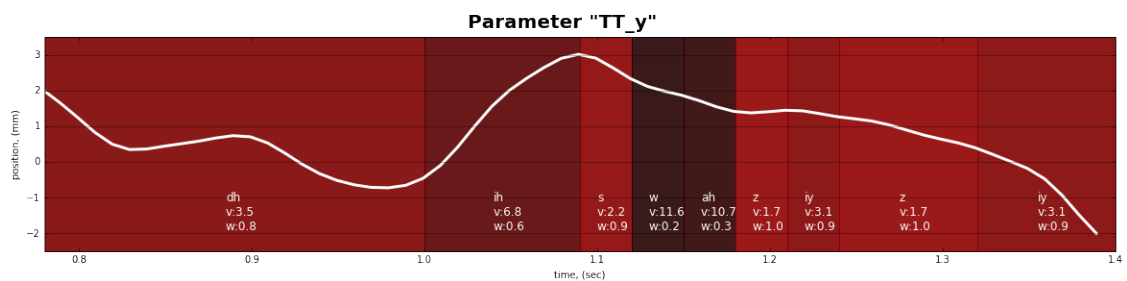
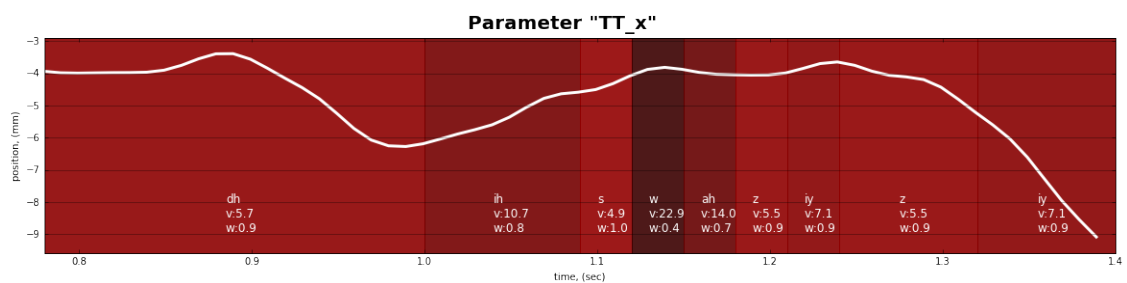
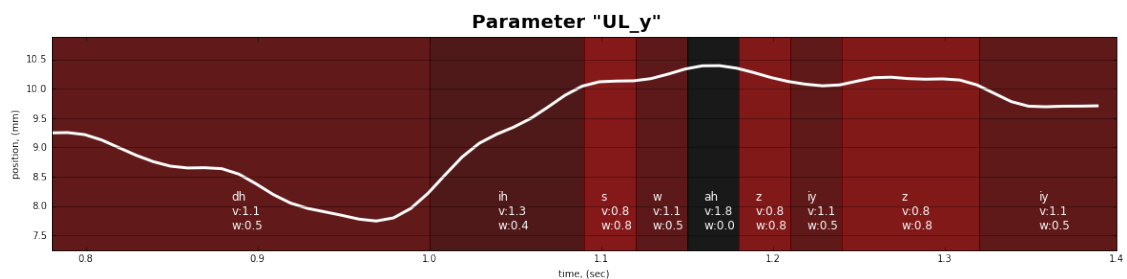
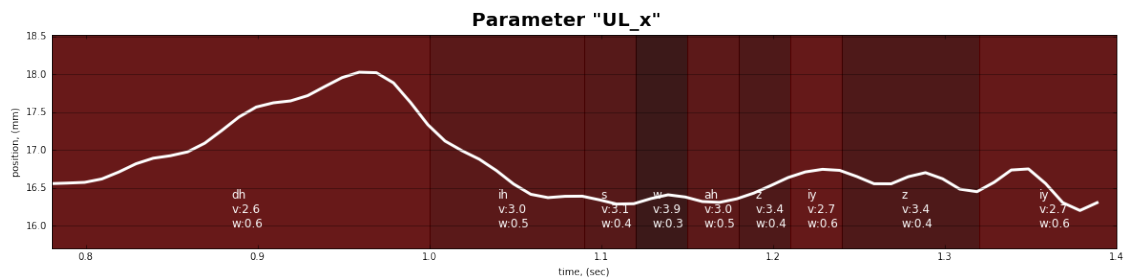
    width = t_ends[i]-t_starts[i]
    ax.add_patch(patches.Rectangle((t_starts[i], p_min),
                                   width, height, color=clr, alpha=0.9))
    text1 = "{0}\nv:{1:0.1f}\nw:{2:0.1f}".format(phonemes[i], v,w)
    ax.text(t_starts[i]+width/2-0.005,
            p_min+height/10, text1, fontsize=12, color='w')

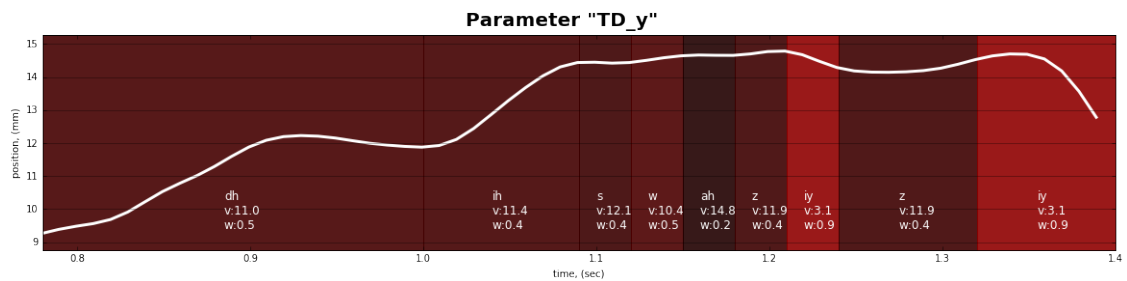
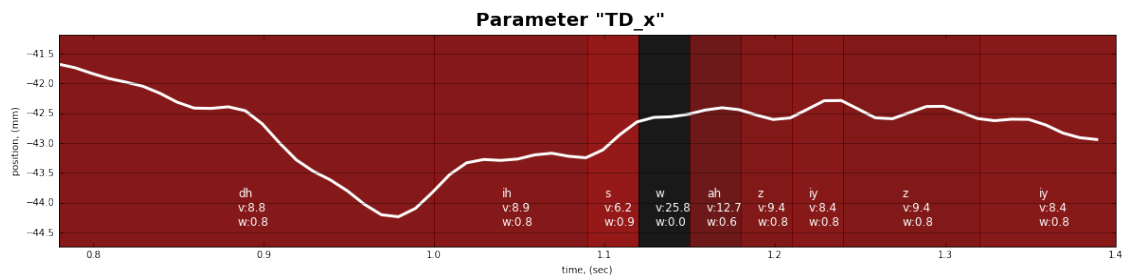
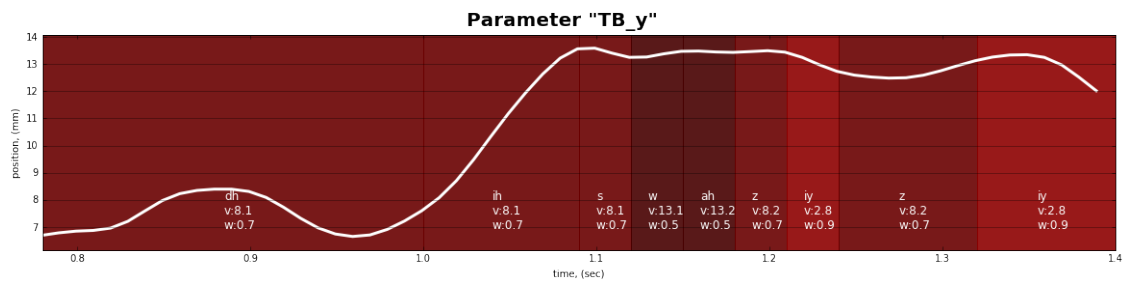
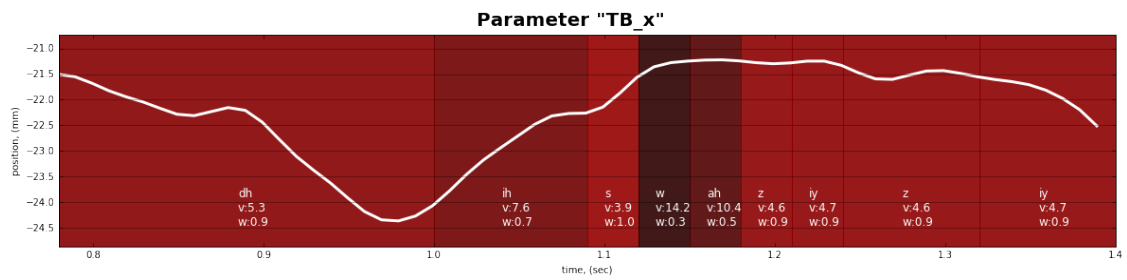
t = range(i_start,i_end)
t = [i / srates[p_name] for i in t]
ax.plot(t, y, color="w", linewidth=3)

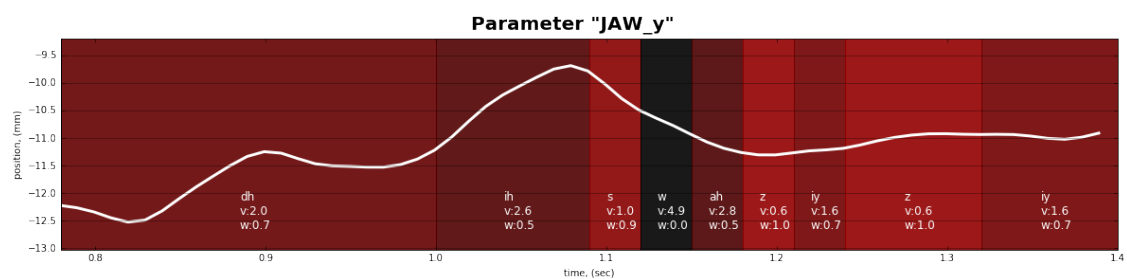
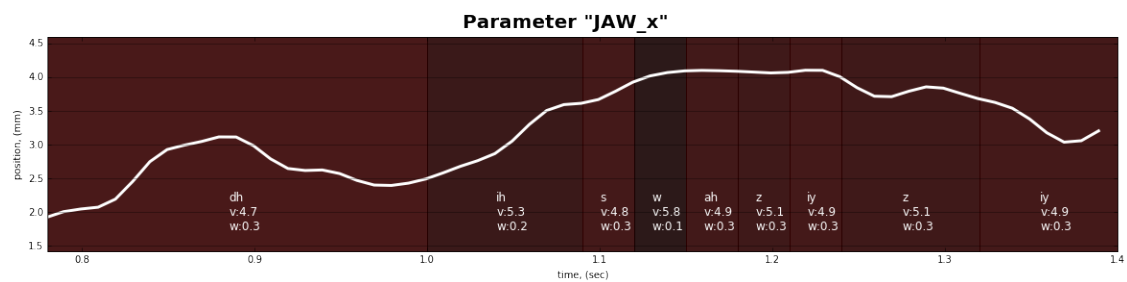
plt.show()

```









In [ ]: