Load the Hillenbrand vowel database:

- (1) Download the Hillenbrand vowel database (.zip files)
 http://homepages.wmich.edu/~hillenbr/voweldata.html
- (2) Extract files to local directory (download Winzip): http://www.winzip.com/download.htm>
- (3) Start Matlab and load the acoustic measurements (text files):

Coarse sampling < http://homepages.wmich.edu/~hillenbr/voweldata/vowdata.dat>

(4) Create vowel, talker group, and talker number codes

- (5) Make histograms of the acoustic measurements, separately for the 4 talker groups.
 - % For example: plot the **adult male** fundamental frequencies:

```
x = F0s(find(talker_group_code==1));
figure(1);
subplot(221);
hist(x,20);
% use 20 "bins"
set(gca,'XLim',[50 500]); % set x-axis limits between 50 & 500 Hz
title('adult males');
```

% Next plot the **adult female** fundamental frequencies:

```
x = F0s(find(talker_group_code==2));
subplot(222);
hist(x,20); % use 20 bins
```

```
set(gca,'XLim',[50 500]); % set x-axis limits
title('adult females');
```

- % Next, plot the fundamental frequencies for **boys** and **girls** (separately)
- (6) Repeat the steps in (5) for each of the remaining variables (dur, F1s, F2s, ... F380) and print out the figures.
- (7) Calculate the means for each variable, separately for each of the 4 talker groups. Write a brief descriptive paragraph noting the patterns across the four groups.

```
x = F0s(find(talker_group_code==1));
mx = mean(x);
disp('Mean F0 for males:')
disp(mx);
```

(8) Find and remove all F0 values that are more than 2 standard deviations above or below the mean, remove these and re-calculate the mean F0. Does it change?

```
x = F0s(find(talker_group_code==1));
mx = mean(x);
disp('Mean F0 for males:')
disp(mx);
sd2 = std(x) * 2;
ind_higher = find( x > mx+sd2 );
ind_lower = find( x < mx - sd2 );
ind = intersection ( ind_higher, ind_lower );
x(ind) = [ ];
mx = mean(x);
disp('Mean F0 for males (outliers removed):')
disp(mx);</pre>
```