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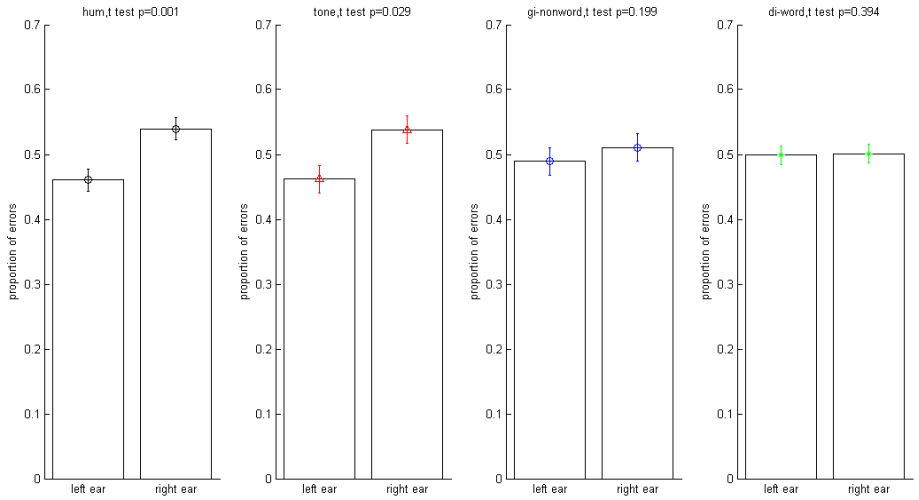
```
clear all; close all;clc
% initialize
cd('C:\Users\ning\Dropbox\NYU\MA thesis\result2')
pool = [11:30];%17,19,21,22,23:24];
for sub = pool
    file(1,sub) = dir(sprintf('Dichotichum*%d*',sub));
    file(2,sub) = dir(sprintf('Dichotictone*%d*',sub));
    file(3,sub) = dir(sprintf('Dichoticgi*%d*',sub));
    file(4,sub) = dir(sprintf('Dichoticdi*%d*',sub));
end
```

show by errors made

```
% errors made from the left ear is all the responses don't match to stimuli
% from the left
% errors made from the right ear is all the responses don't match to the
% stimuli from the right

% preallocation, zeros(condition,[left,right],subject number)
result=zeros(4,2,length(pool));
for i = 1:4
    for ii = 1:length(pool)
        load(file(i,pool(ii)).name)
        [~,Dichotic]=DichoticErrorTone_toneExcluded(Output,0,5,[]);
        result(i,:,ii) = [Dichotic.LeftPOE,Dichotic.RightPOE];
    end
end

soundtype={'hum','tone','gi-nonword','di-word'};

% standard error
eleft = std(result(:,1,:),0,3)./sqrt(length(pool));
eright = std(result(:,2,:),0,3)./sqrt(length(pool));

figure('units','normalized','outerposition',[0 0 1 1])
colors = {'ko','r^','bo','g*'};
for i = 1:4
```

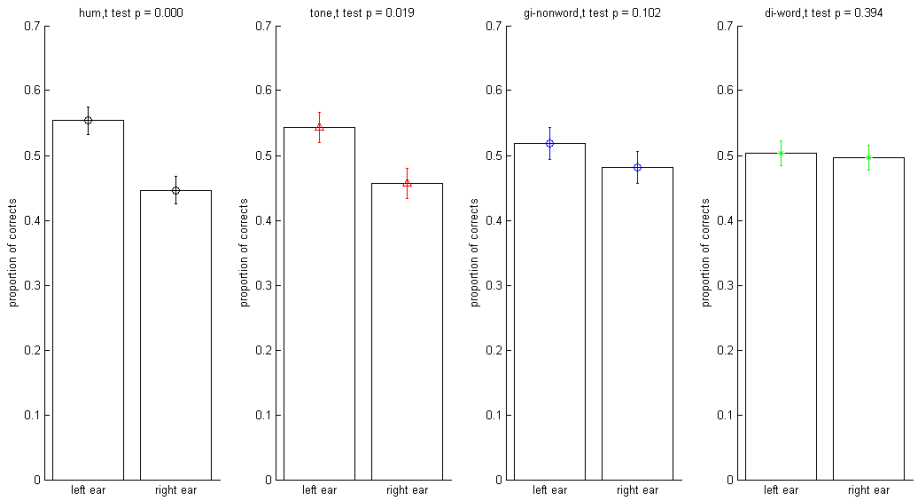
```
    subplot(1,4,i)
    % nonparameteric t test - Mann-Whitney U test
    p(i) = ranksum(reshape(result(i,1,:),1,length(pool)),...
        reshape(result(i,2,:),1,length(pool)));
    bar([1,2],[mean(result(i,1,:),3),mean(result(i,2,:),3)],...
        'facecolor','w');hold on
    title(sprintf([soundtype{i},',','t test p=%.3f'],p(i)))
    errorbar([1,2],[mean(result(i,1,:),3),mean(result(i,2,:),3)],...
        [eleft(i),eright(i)],colors{i})
    set(gca,'xtick',[1,2])
    set(gca,'xticklabel',{'left ear','right ear'})
    ylabel('proportion of errors')
    box off
end
set(gcf, 'color','w')
```



show by correction

```
% left / (left + right)
% right / (left + right)

% preallocation, zeros(condition,[left,right],subject number)
result=zeros(4,2,length(pool));
for i = 1:4
    for ii = 1:length(pool)
        load(file(i,pool(ii)).name)
        [~,Dichotic]=DichoticErrorTone_toneExcluded(Output,0,5,[]);
        result(i,:,ii) = [Dichotic.LEA,Dichotic.REA];
    end
end

soundtype={'hum','tone','gi-nonword','di-word'};

% standard error
eleft = std(result(:,1,:),0,3)./sqrt(length(pool));
```

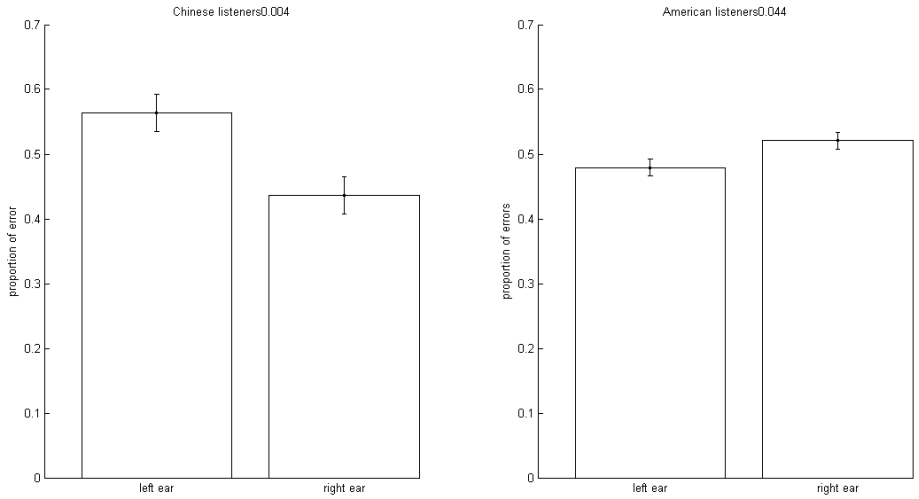
```
eright = std(result(:,2,:),0,3)./sqrt(length(pool));

figure('units','normalized','outerposition',[0 0 1 1])
colors = {'ko','r^','bo','g*'};
for i = 1:4
    subplot(1,4,i)
    % nonparameteric t test - Mann-Whitney U test
    p(i) = ranksum(reshape(result(i,1,:),1,length(pool)),...
        reshape(result(i,2,:),1,length(pool)));
    bar([1,2],[mean(result(i,1,:),3),mean(result(i,2,:),3)],...
        'facecolor','w');hold on
    title(sprintf([soundtype{i},',','t test p = %.3f'],p(i)))
    errorbar([1,2],[mean(result(i,1,:),3),mean(result(i,2,:),3)],...
        [eleft(i),eright(i)],colors{i})
    set(gca,'xtick',[1,2])
    set(gca,'xticklabel',{'left ear','right ear'})
    ylabel('proportion of corrects')
    box off
end
set(gcf, 'color', 'w')
```



Wang et al. 2001, showed by errors

```
% Chinese listeners
Left = [44,61,22,34,36,42,43,44,75,16,48,38,75,24,35,48,42,25,11,26];
Right = [6,20,10,19,21,24,27,29,54,13,40,33,69,23,34,53,50,33,18,54];

% percentage of errors made by each ear
LeftPOE = Left ./ (Left + Right);
RightPOE = Right ./ (Left + Right);

% standard error
eLeft = std(LeftPOE') ./ sqrt(length(Left));
eRight = std(RightPOE') ./ sqrt(length(Right));
```

```
figure('units','normalized','outerposition',[0 0 1 1])
subplot(121)
% nonparameteric t test - Mann-Whitney U test
p(5) = ranksum(LeftPOE,RightPOE);
bar([1,2],[mean(LeftPOE),mean(RightPOE)],'facecolor','w');hold on
errorbar([1,2],[mean(LeftPOE),mean(RightPOE)],[eLeft,eRight],'k.');
set(gca,'xtick',[1,2])
set(gca,'xticklabel',{'left ear','right ear'})
title(sprintf(['Chinese listeners','%.3f'],p(5)))
ylabel('proportion of error')
box off


% American listeners
Left = [29,16,44,57,37,22,40,42,34,41,33,30,38,40,14,42,39,17,22,34];
Right = [21,13,37,52,34,20,39,41,36,42,37,34,45,46,17,51,51,24,34,64];

% percentage of error
LeftPOE = Left ./ (Left + Right);
RightPOE = Right ./ (Left + Right);

% standard error
eLeft = std(LeftPOE') ./ sqrt(length(Left));
eRight = std(RightPOE') ./ sqrt(length(Right));


subplot(122)
% nonparameteric t test - Mann-Whitney U test
p(6) = ranksum(LeftPOE,RightPOE);
bar([1,2],[mean(LeftPOE),mean(RightPOE)],'facecolor','w');hold on
errorbar([1,2],[mean(LeftPOE),mean(RightPOE)],[eLeft,eRight],'k.');
set(gca,'xtick',[1,2])
set(gca,'xticklabel',{'left ear','right ear'})
title(sprintf(['American listeners','%.3f'],p(6)))
ylabel('proportion of errors')
box off
set(gcf, 'color','w')
```



stacked bar graph including Wang et al. 2001

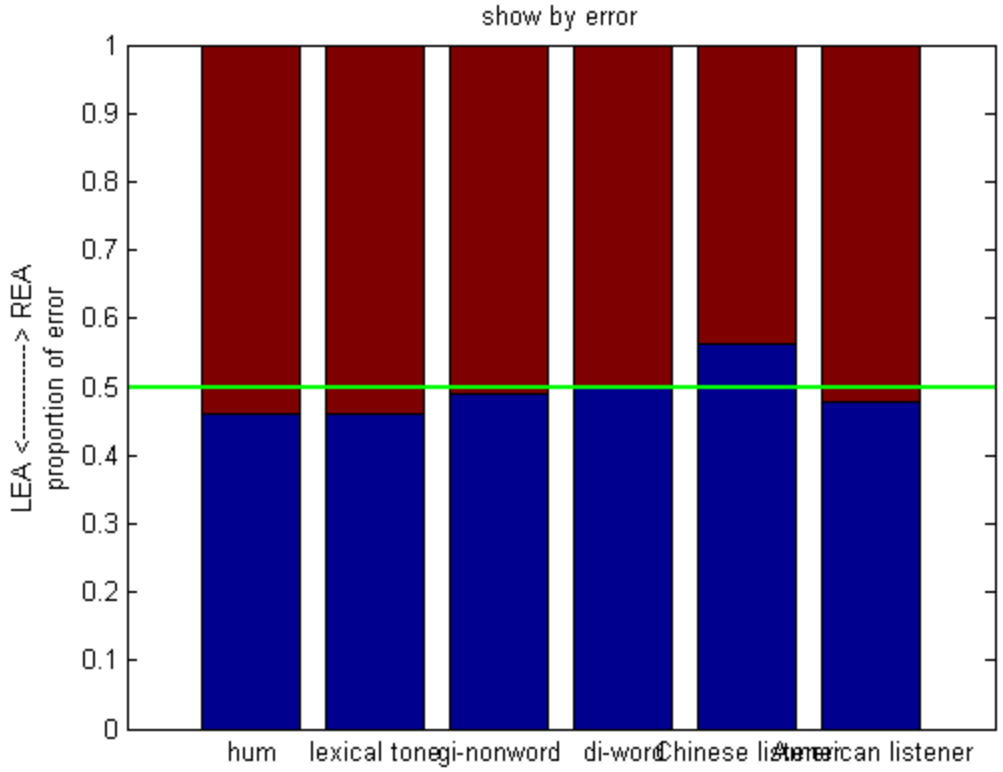
error bars including Wang et al. 2001 showed using percentage of error

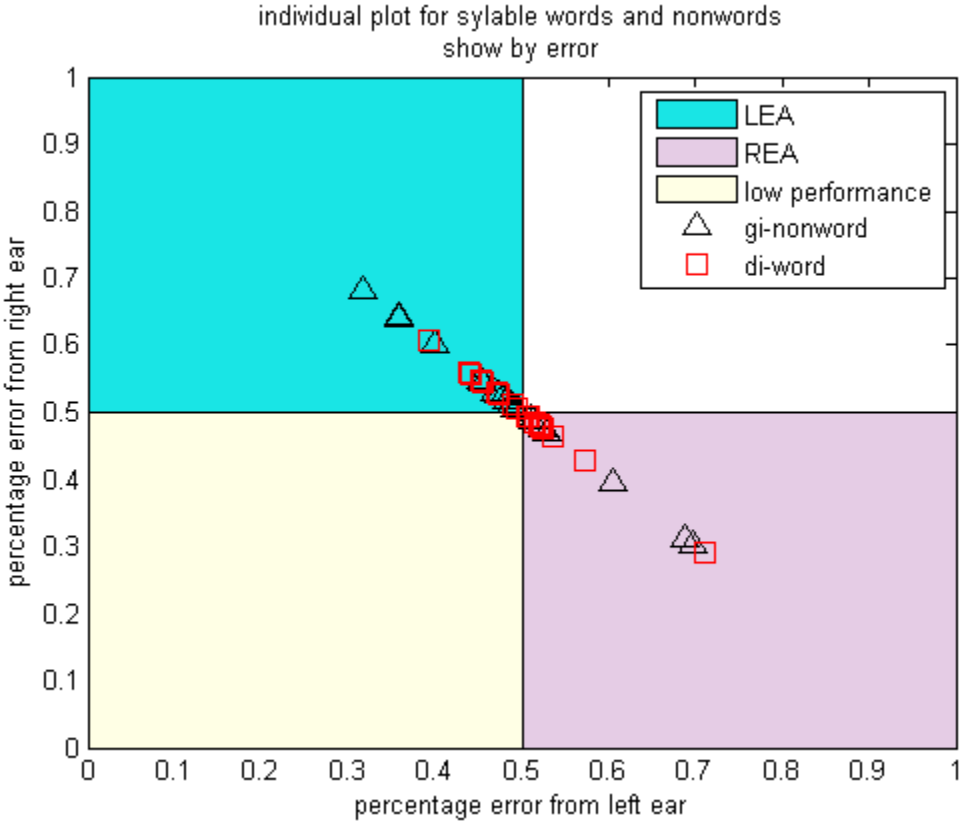
```
% This part includes all data from 2 phases of experiment
% Red represent phase 1, including {hum, lexical tone}
% Blue represent phase 2, including {hum, lexical tone, gi-nonword,
% di-word}


clear all;clc
cd('C:\Users\ning\Dropbox\NYU\MA thesis\result2')
pool = [11:30];%17,19,21,22,23:24];
%pool=setxor([11:29],27)
for sub = pool
    file(1,sub) = dir(sprintf('Dichotichum*%d*',sub));
    file(2,sub) = dir(sprintf('Dichotictone*%d*',sub));
    file(3,sub) = dir(sprintf('Dichoticgi*%d*',sub));
    file(4,sub) = dir(sprintf('Dichoticdi*%d*',sub));
end

result=zeros(4,2,length(pool));
for i = 1:4
    for ii = 1:length(pool)

        load(file(i,pool(ii)).name)
        [~,Dichotic]=DichoticErrorTone_toneExcluded(Output,0,5,[]);
        result(i,:,ii) = [Dichotic.LeftPOE,Dichotic.RightPOE];

    end
    leftcol(i,:) = reshape(result(i,1,:),1,length(pool));
    rightcol(i,:) = reshape(result(i,2,:),1,length(pool));
end

soundtype={'hum','tone','gi-nonword','di-word'};
```

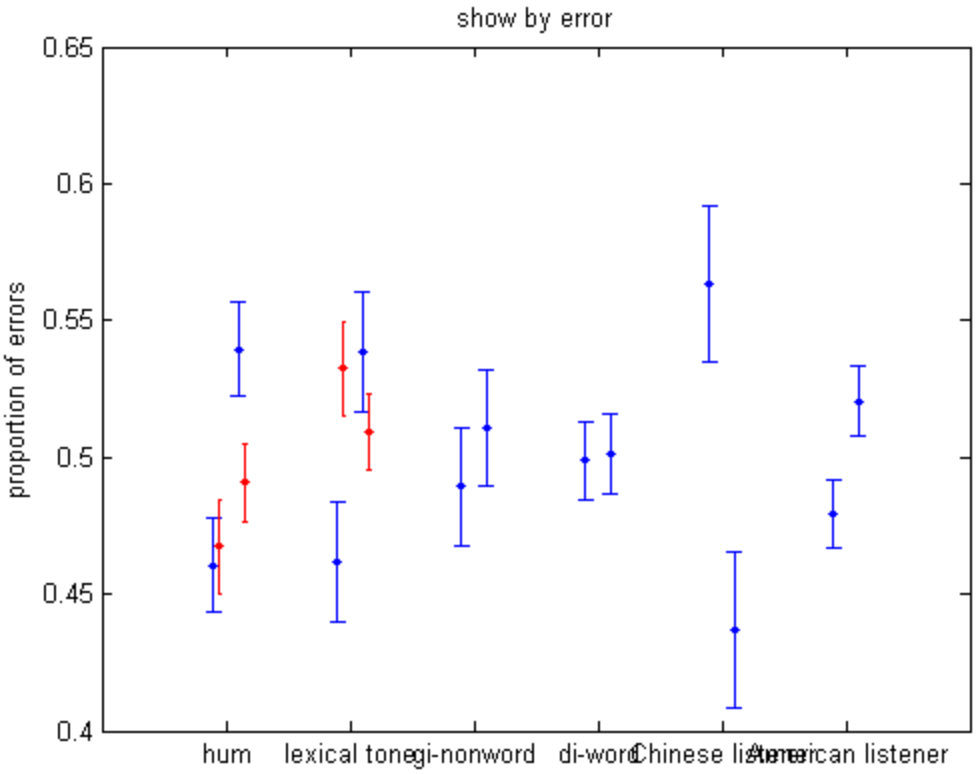
```
% standard error
eleft = std(result(:,1,:),0,3)./sqrt(length(pool));
eright = std(result(:,2,:),0,3)./sqrt(length(pool));


% Chinese listeners
Left(1,:) = [44,61,22,34,36,42,43,44,75,16,48,38,75,24,35,48,42,25,11,26];
Right(1,:) = [6,20,10,19,21,24,27,29,54,13,40,33,69,23,34,53,50,33,18,54];

% American listeners
Left(2,:) = [29,16,44,57,37,22,40,42,34,41,33,30,38,40,14,42,39,17,22,34];
Right(2,:) = [21,13,37,52,34,20,39,41,36,42,37,34,45,46,17,51,51,24,34,64];

LeftPOE = Left ./ (Left + Right);
RightPOE = Right ./ (Left + Right);

eLeft = std(LeftPOE') ./ sqrt(length(Left));
eRight = std(RightPOE') ./ sqrt(length(Right));

figure(4)
mean_leftcol = mean(leftcol');
mean_rightcol = mean(rightcol');

mean_leftcol = [mean_leftcol,mean(LeftPOE')];
mean_rightcol = [mean_rightcol,mean(RightPOE')];

grand_eleft = [eleft',eLeft];
grand_eright = [eright',eRight];

grand_errorbars = [grand_eleft;grand_eright];

grand_mean = [mean_leftcol;mean_rightcol];

bar(grand_mean','stacked');
set(gca,'xticklabel',{'hum','lexical tone','gi-nonword','di-word',...
    'Chinese listener','American listener'});
line([0,7],[0.5,0.5],'color','g','linewidth',2)
ylabel(sprintf('LEA <------------> REA\nproportion of error'))
title('show by error')

figure(5)
X_ticks = [0.9,1.1,1.9,2.1,2.9,3.1,3.9,4.1,4.9,5.1,5.9,6.1];
errorbar(X_ticks,reshape(grand_mean,1,12),reshape(grand_errorbars,1,12),'b.')
set(gca,'xtick',1:6,'xticklabel',{'hum','lexical tone','gi-nonword','di-word',...
    'Chinese listener','American listener'});


figure(6)
% shade the areas
xx =[0 0 0.5 0.5];yy=[0.5 1 1 0.5];
fill(xx,yy,[0.1 0.9 0.9]);hold on
xx =[0.5 0.5 1 1];yy=[0 0.5 0.5 0];
fill(xx,yy,[0.9 0.8 0.9])
```

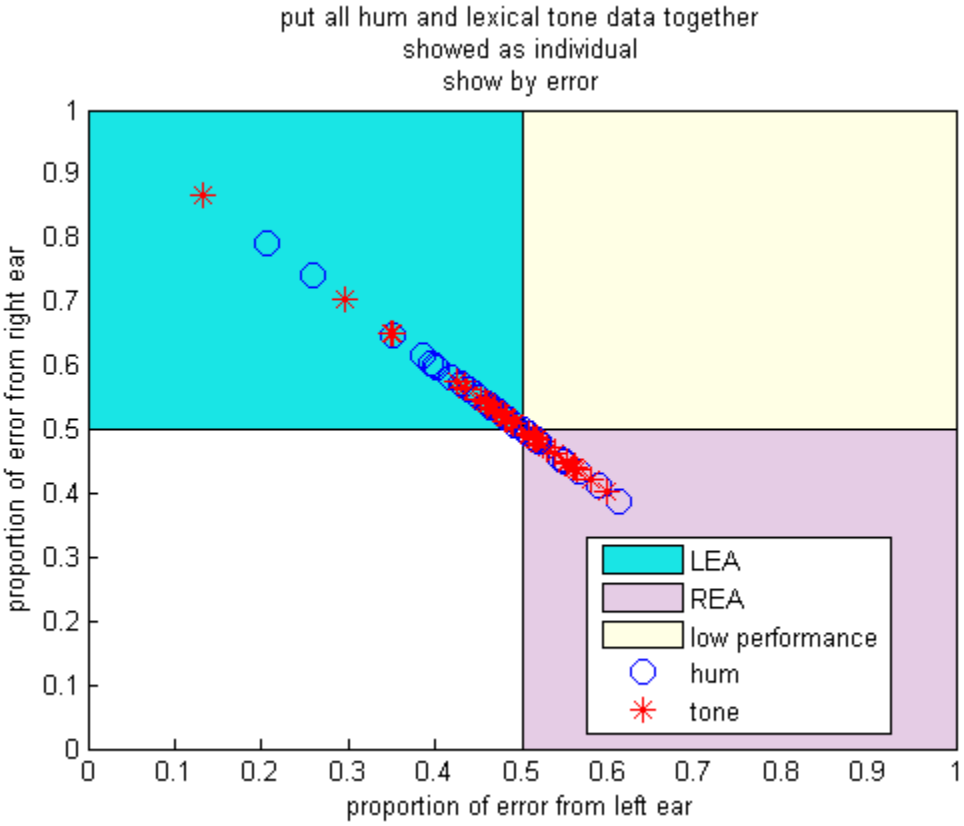
```
xx =[0.5 0.5 1 1];yy=[0.5 1 1 0.5];
fill(xx,yy,[1 1 .9])
colors={'b','r','k','r'};markers={'o','*','^','s'};
% plot only hum and lexical tones
for i = 1:2
    hold on
    pp=plot(reshape(result(i,1,:),1,length(pool)),reshape(result(i,2,:),1,...
        length(pool)),'marker',markers{i});hold on
    set(pp,'LineStyle','none','Color',colors{i},'MarkerSize',10)
end
xlabel('proportion of error from left ear')
ylabel('proportion of error from right ear')

figure(11)
% shade the areas
xx =[0 0 0.5 0.5];yy=[0.5 1 1 0.5];
fill(xx,yy,[0.1 0.9 0.9]);hold on
xx =[0.5 0.5 1 1];yy=[0 0.5 0.5 0];
fill(xx,yy,[0.9 0.8 0.9])
xx =[0 0 0.5 0.5];yy=[0 0.5 0.5 0];
fill(xx,yy,[1 1 .9])
% plot gi-nonword and di-word
for i = 3:4
    hold on
    pp = plot(reshape(result(i,1,:),1,length(pool)),reshape(result(i,2,:),1,...
        length(pool)),'marker',markers{i});hold on
    set(pp,'LineStyle','none','Color',colors{i},'MarkerSize',10)
end
xlabel('percentage error from left ear')
ylabel('percentage error from right ear')
legend('LEA','REA','low performance','gi-nonword','di-word')
title(sprintf('individual plot for sylable words and nonwords\nshow by error'))

cd('C:\Users\ning\Dropbox\NYU\MA thesis\result')
pool = 1:24;
Takes = ones(1,24);
Takes([4,5,19,20]) = 0;% excluded
pool = nonzeros(pool(:) .* Takes(:));
pool = [0;pool]';
for sub = pool
    file(5,sub+1) = dir((sprintf('DichotichumClassic_%d.mat',sub)));
    file(6,sub+1) = dir((sprintf('DichotictoneClassic_%d.mat',sub)));
end

result=zeros(2,2,length(pool));
slot=[5,6];
for i = 1:2
    for ii = 1:length(pool)

        load(file(slot(i),pool(ii)+1).name)
        [~,Dichotic]=DichoticErrorTone_toneExcluded(Output,0,5,[]);
        result(i,:,ii) = [Dichotic(1).LeftPOE,Dichotic(1).RightPOE];
    end
end
```

```
soundtype={'hum','tone'};

mean_left = mean(result(:,1,:),3);
mean_right = mean(result(:,2,:),3);

Eleft = std(result(:,1,:),0,3)./sqrt(length(pool));
Eright = std(result(:,2,:),0,3)./sqrt(length(pool));

figure(5)
hold on
X_ticks = [0.95,1.15,1.95,2.15];
errorbar(X_ticks,reshape([mean_left,mean_right],1,4),...
    reshape([Eleft,Eright],1,4),'r.')

ylabel('proportion of errors')
title('show by error')

figure(6)
hold on
colors={'b','r'};markers={'o','*'};
for i = 1:2
    pp=plot(reshape(result(i,1,:),1,length(pool)),reshape(result(i,2,:),1,...
        length(pool)),'marker',markers{i});hold on
    set(pp,'LineStyle','none','Color',colors{i},'MarkerSize',10)
end
legend('LEA','REA','low performance','hum','tone','location','best')
title(sprintf('put all hum and lexical tone data together\nshowed as individual\ns
```


show by error
LEA <----------> REA
proportion of error
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
hum
lexical tone
gi-nonword
di-word
Chinese listener
American listener


individual plot for sylable words and nonwords
show by error
LEA
REA
low performance
gi-nonword
di-word
percentage error from right ear
percentage error from left ear
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1


show by error
proportion of errors
0.65
0.6
0.55
0.5
0.45
0.4
hum
lexical tone
di-nonword
di-word
Chinese listener
American listener


put all hum and lexical tone data together
showed as individual
show by error
proportion of error from right ear
proportion of error from left ear
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
LEA
REA
low performance
hum
tone

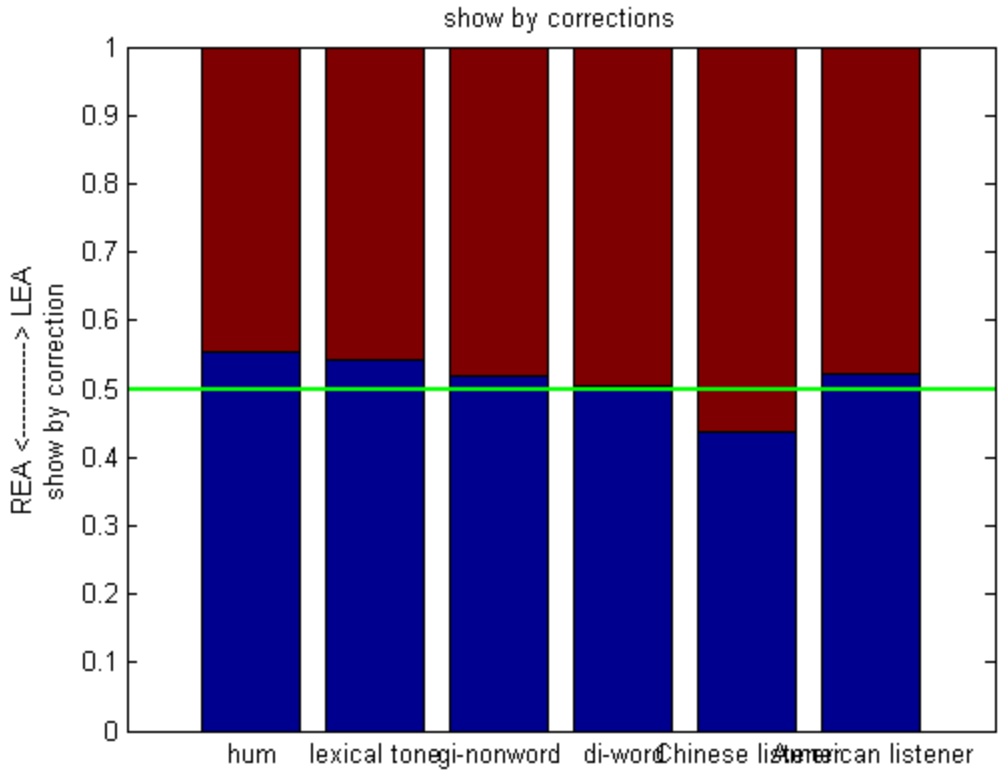
stacked bar graph including Wang et al. 2001

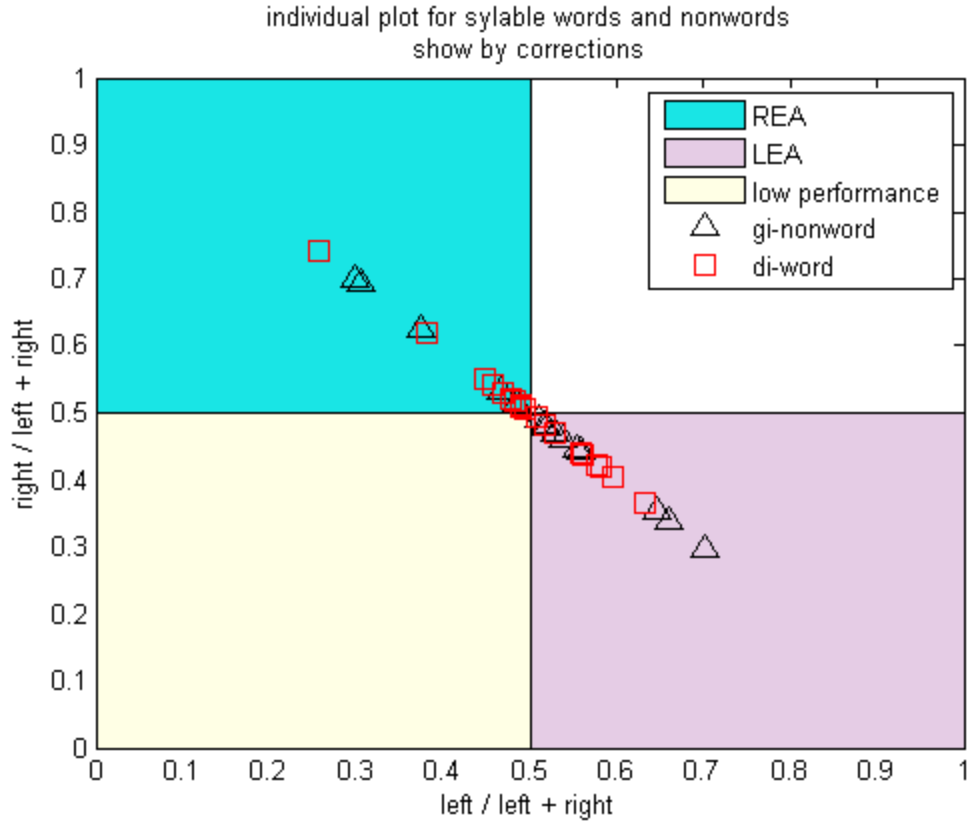
```
% error bars including Wang et al. 2001
% showed using percentage of correction

clear all;clc
cd('C:\Users\ning\Dropbox\NYU\MA thesis\result2')

pool = [11:30];%17,19,21,22,23:24];
for sub = pool
    file(1,sub) = dir(sprintf('Dichotichum*%d*',sub));
    file(2,sub) = dir(sprintf('Dichotictone*%d*',sub));
    file(3,sub) = dir(sprintf('Dichoticgi*%d*',sub));
    file(4,sub) = dir(sprintf('Dichoticdi*%d*',sub));
end

result=zeros(4,2,length(pool));

for i = 1:4
    for ii = 1:length(pool)
        load(file(i,pool(ii)).name)
        [~,Dichotic]=DichoticErrorTone_toneExcluded(Output,0,5,[]);
        result(i,:,ii) = [Dichotic.LEA,Dichotic.REA];

    end
    leftcol(i,:) = reshape(result(i,1,:),1,length(pool));
    rightcol(i,:) = reshape(result(i,2,:),1,length(pool));
end

soundtype={'hum','tone','gi-nonword','di-word'};

% standard error
eleft = std(result(:,1,:),0,3)./sqrt(length(pool));
eright = std(result(:,2,:),0,3)./sqrt(length(pool));

% Chinese listeners
Left(1,:) = [44,61,22,34,36,42,43,44,75,16,48,38,75,24,35,48,42,25,11,26];
Right(1,:) = [6,20,10,19,21,24,27,29,54,13,40,33,69,23,34,53,50,33,18,54];

% American listeners
Left(2,:) = [29,16,44,57,37,22,40,42,34,41,33,30,38,40,14,42,39,17,22,34];
Right(2,:) = [21,13,37,52,34,20,39,41,36,42,37,34,45,46,17,51,51,24,34,64];

LEA = 1 - Left ./ (Left + Right);
REA = 1 - Right ./ (Left + Right);

eLeft = std(LEA') ./ sqrt(length(Left));
eRight = std(REA') ./ sqrt(length(Right));

figure(7)
mean_leftcol = mean(leftcol');
mean_rightcol = mean(rightcol');
```

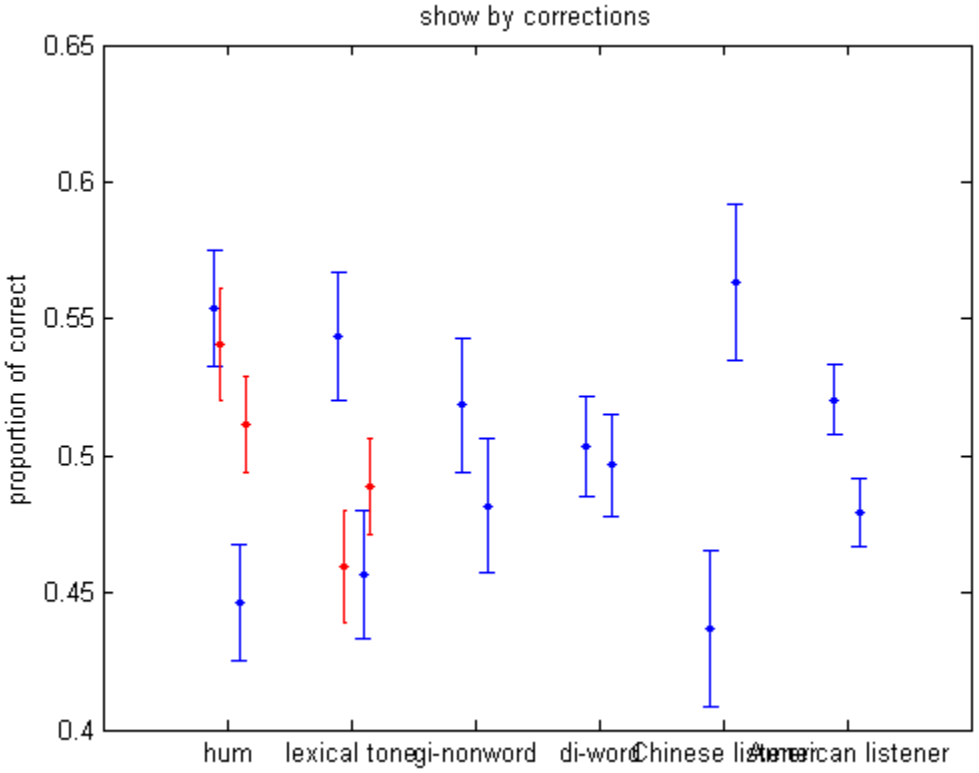
```
mean_leftcol = [mean_leftcol,mean(LEA')];
mean_rightcol = [mean_rightcol,mean(REA')];

grand_eleft = [eleft',eLeft];
grand_eright = [eright',eRight];

grand_errorbars = [grand_eleft;grand_eright];

grand_mean = [mean_leftcol;mean_rightcol];

bar(grand_mean','stacked')
set(gca,'xticklabel',{'hum','lexical tone','gi-nonword','di-word',...
    'Chinese listener','American listener'});
line([0,7],[0.5,0.5],'color','g','linewidth',2)
ylabel(sprintf('REA <------------> LEA\nshow by correction'))
title('show by corrections')

figure(8)
X_ticks = [0.9,1.1,1.9,2.1,2.9,3.1,3.9,4.1,4.9,5.1,5.9,6.1];
errorbar(X_ticks,reshape(grand_mean,1,12),reshape(grand_errorbars,1,12),'b.')
set(gca,'xtick',1:6,'xticklabel',{'hum','lexical tone','gi-nonword','di-word',...
    'Chinese listener','American listener'});

figure(9)
% shade the areas
xx =[0 0 0.5 0.5];yy=[0.5 1 1 0.5];
fill(xx,yy,[0.1 0.9 0.9]);hold on
xx =[0.5 0.5 1 1];yy=[0 0.5 0.5 0];
fill(xx,yy,[0.9 0.8 0.9])
xx =[0 0 0.5 0.5];yy=[0 0.5 0.5 0];
fill(xx,yy,[1 1 .9])
colors={'b','r','k','r'};markers={'o','*','^','s'};
% plot only hum and lexical tones
for i = 1:2
    hold on
    pp=plot(reshape(result(i,1,:),1,length(pool)),reshape(result(i,2,:),1,...
        length(pool)),'marker',markers{i});hold on
    set(pp,'LineStyle','none','Color',colors{i},'MarkerSize',10)
end
xlabel('left / left + right')
ylabel('right / left + right')


figure(10)
% shade the areas
xx =[0 0 0.5 0.5];yy=[0.5 1 1 0.5];
fill(xx,yy,[0.1 0.9 0.9]);hold on
xx =[0.5 0.5 1 1];yy=[0 0.5 0.5 0];
fill(xx,yy,[0.9 0.8 0.9])
xx =[0 0 0.5 0.5];yy=[0 0.5 0.5 0];
fill(xx,yy,[1 1 .9])
% plot gi-nonword and di-word
for i = 3:4
    hold on
```

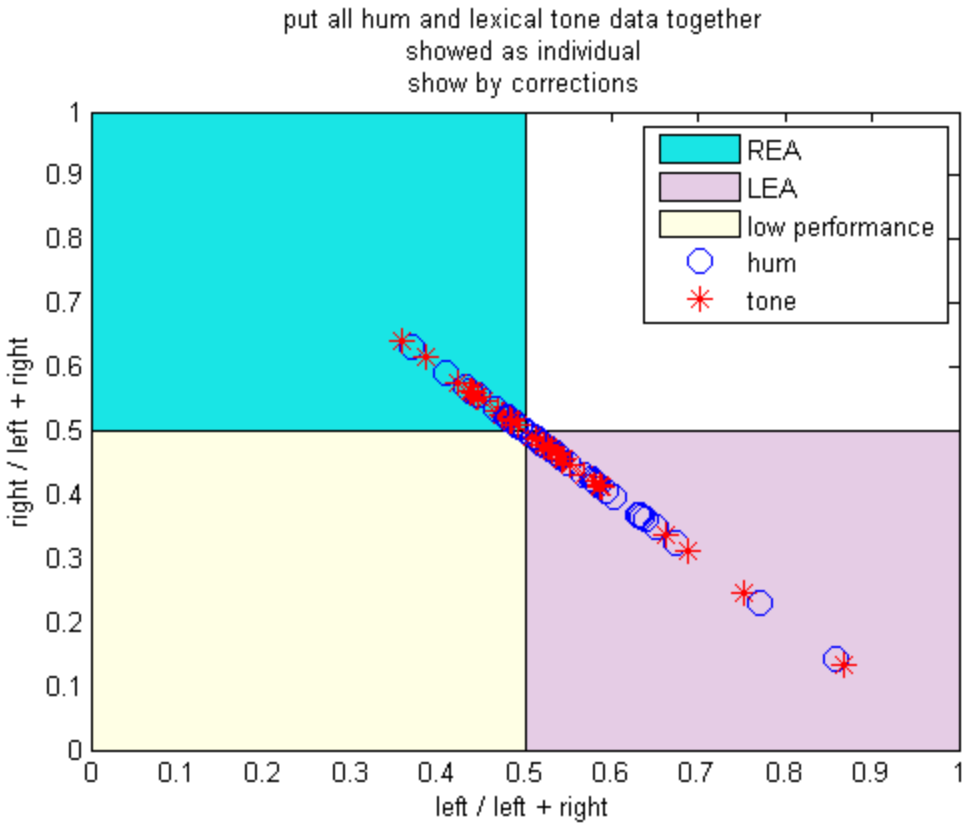
```
    pp = plot(reshape(result(i,1,:),1,length(pool)),reshape(result(i,2,:),1,...
        length(pool)),'marker',markers{i});hold on
    set(pp,'LineStyle','none','Color',colors{i},'MarkerSize',10)
end
xlabel('left / left + right')
ylabel('right / left + right')
legend('REA','LEA','low performance','gi-nonword','di-word')
title(sprintf('individual plot for sylable words and nonwords\nshow by corrections

% direct to experiment 1
cd('C:\Users\ning\Dropbox\NYU\MA thesis\result')
pool = 1:24;
Takes = ones(1,24);
Takes([4,5,19,20]) = 0;% excluded
pool = nonzeros(pool(:) .* Takes(:));
pool = [0;pool]';
for sub = pool
    file(5,sub+1) = dir((sprintf('DichotichumClassic_%d.mat',sub)));
    file(6,sub+1) = dir((sprintf('DichotictoneClassic_%d.mat',sub)));
end

result=zeros(2,2,length(pool));
slot=[5,6];
for i = 1:2
    for ii = 1:length(pool)
        load(file(slot(i),pool(ii)+1).name)
        [~,Dichotic]=DichoticErrorTone_toneExcluded(Output,0,5,[]);
        result(i,:,ii) = [Dichotic(1).LEA,Dichotic(1).REA];
    end
end

soundtype={'hum','tone'};

mean_left = mean(result(:,1,:),3);
mean_right = mean(result(:,2,:),3);

Eleft = std(result(:,1,:),0,3)./sqrt(length(pool));
Eright = std(result(:,2,:),0,3)./sqrt(length(pool));

figure(8)
hold on
X_ticks = [0.95,1.15,1.95,2.15];
errorbar(X_ticks,reshape([mean_left,mean_right],1,4),...
    reshape([Eleft,Eright],1,4),'r.')

ylabel('proportion of correct')
title('show by corrections')


figure(9)
hold on
colors={'b','r'};cnt=1;markers={'o','*'};
for i = 1:2
    pp=plot(reshape(result(i,1,:),1,length(pool)),reshape(result(i,2,:),1,...
```

```
        length(pool)),'marker',markers{i});hold on
    set(pp,'LineStyle','none','Color',colors{i},'MarkerSize',10)
end
legend('REA','LEA','low performance','hum','tone')
title(sprintf('put all hum and lexical tone data together\nshowed as individual\ns
```




individual plot for sylable words and nonwords
show by corrections
REA
LEA
low performance
gi-nonword
di-word
right / left + right
left / left + right
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

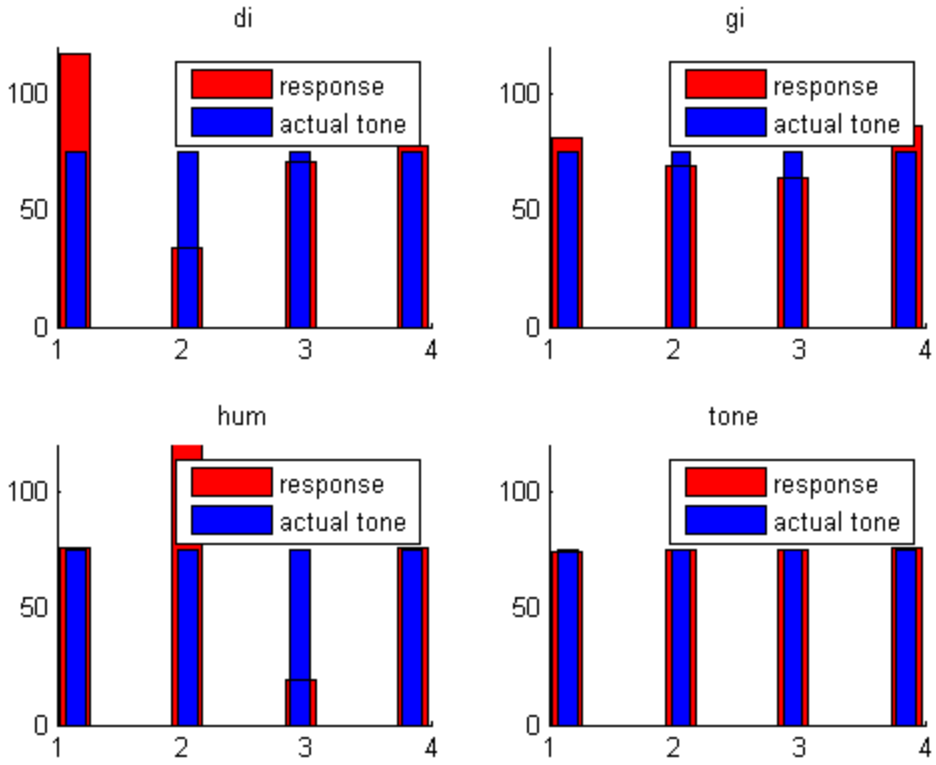

show by corrections
proportion of correct
0.65
0.6
0.55
0.5
0.45
0.4
hum
lexical tone
gi-nonword
di-word
Chinese listener
American listener



tone regonition

```
clear all; close all; clc
cd('C:\Users\ning\Dropbox\NYU\MA thesis\result2')
st = dir('ToneRe*.mat');
names={'di','gi','hum','tone'};
responses= zeros(4,20,length(st));
for ii = 1:length(st)
    load(st(ii).name)
    for i = 1:4
        if strcmp(Output(i).soundtype,names{1})
            responses(1,:,ii) = str2num(Output(i).response');
            RightActual(1,:,ii) = Output(i).Right;
        elseif strcmp(Output(i).soundtype,names{2})
            responses(2,:,ii) = str2num(Output(i).response');
            RightActual(2,:,ii) = Output(i).Right;
        elseif strcmp(Output(i).soundtype,names{3})
            responses(3,:,ii) = str2num(Output(i).response');
            RightActual(3,:,ii) = Output(i).Right;
        elseif strcmp(Output(i).soundtype,names{4})
            responses(4,:,ii) = str2num(Output(i).response');
            RightActual(4,:,ii) = Output(i).Right;
        end
    end
```

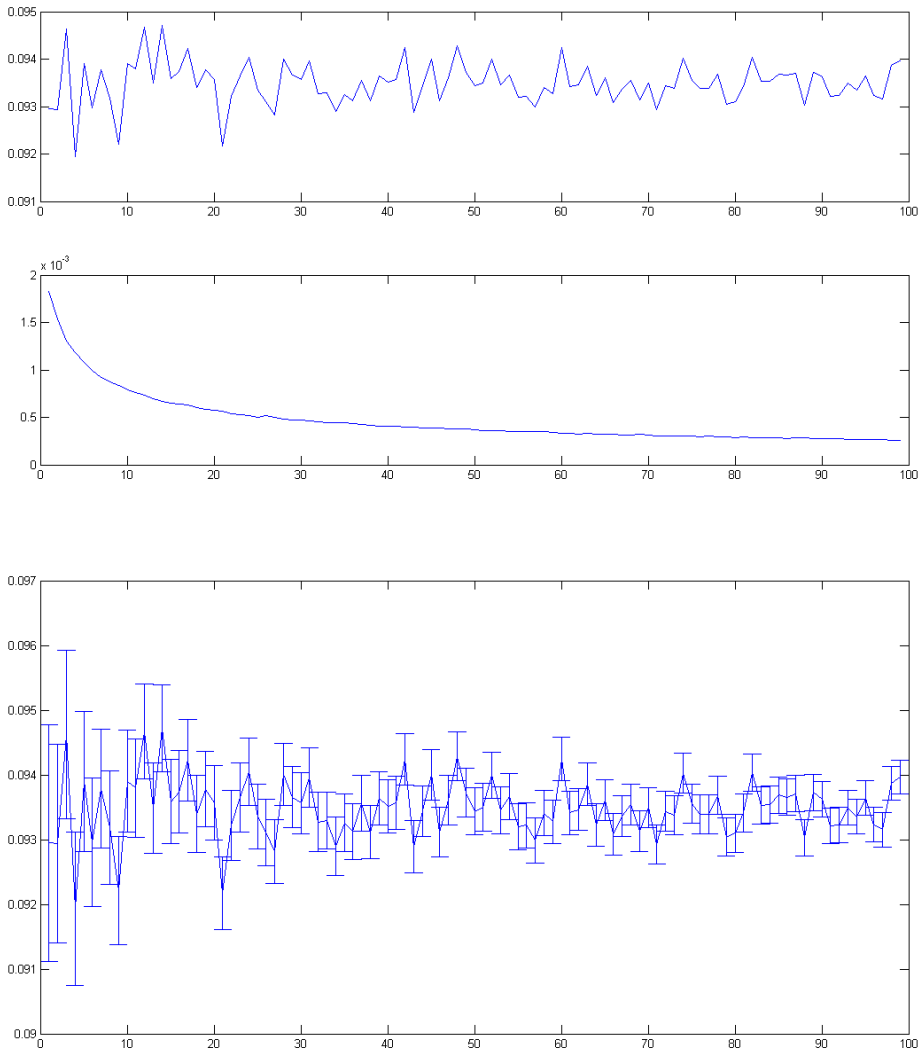
```
end

for i = 1:4
    figure(12)
    Response.(names{i}) = [];
    temp1 = squeeze(responses(i,:,:));
    temp2 = squeeze(RightActual(i,:,:));
    temp1 = temp1(:);
    temp2 = temp2(:);
    Response.(names{i}) = temp1;
    Actual.(names{i}) = temp2;
    subplot(2,2,i)
    [N,X]=hist(temp1);
    bar1=bar(X,N);
    set(bar1,'Facecolor','r');hold on
    [N,X]=hist(temp2);
    bar2=bar(X,N);
    set(bar2,'facecolor','b','barwidth',0.5);hold off
    legend('response','actual tone')
    title(names{i})
    set(gca,'xtick',[1:4])
    ylim([0,120])
    box off
end
set(gcf, 'color','w')
```

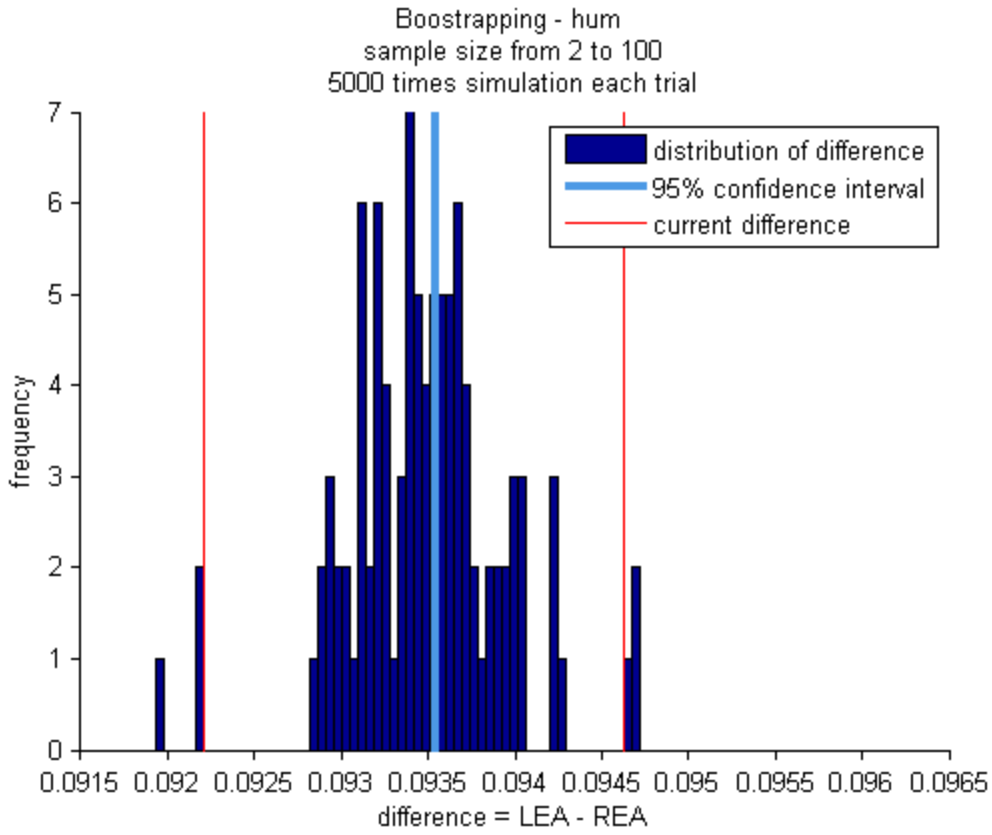


power test - hum

```
clear all; close all; clc
condition = 'hum';sample_size=100;trials=5000;
cd('C:\Users\ning\Dropbox\NYU\MA thesis\result2')
pool = [11:26,28,29];
file = dir(sprintf('Dichotic%sClassic*.mat',condition));
for ii = 1:length(file)
    load(file(ii).name)
    [~,Dichotic]=DichoticErrorTone_toneExcluded(Output,0,5,[]);

    result(ii,:) = [Dichotic.LEA,Dichotic.REA];
end
%
cd('C:\Users\ning\Dropbox\NYU\MA thesis\result')
pool = 1:24;
Takes = ones(1,24);
Takes([4,5,19,20]) = 0;% excluded
pool = nonzeros(pool(:) .* Takes(:));
%pool = [0;pool]';
for ii = 1:length(pool)
    file = dir((sprintf('Dichotic%sClassic_%d.mat',condition,pool(ii))));
    load(file.name)
    [~,Dichotic]=DichoticErrorTone_toneExcluded(Output,0,5,[]);

    result(ii+18,:) = [Dichotic(1).LEA,Dichotic(1).REA];
end
cd('C:\Users\ning\Dropbox\NYU\MA thesis\result2')
Current_difference = mean(result(:,1) - result(:,2));
% permutation test

for ii = 2:sample_size
    for samplingTimes = 1:trials
        samplingTimes;
        subset_pick = randsample([1:length(result)],ii,'true');
        subset_result = result(subset_pick,:);
        % (LEA - REA) / std
        differences(samplingTimes,ii-1) = ...
            mean(subset_result(:,1)-subset_result(:,2));

    end
    mean_sampleSize(ii-1) = mean(differences(:,ii-1));
    el_sampleSize(ii-1) = std(differences(:,ii-1))/sqrt(trials);
end

figure('units','normalized','outerposition',[0 0 1 1])
subplot(211)
plot(mean_sampleSize)
subplot(212)
plot(el_sampleSize)
figure('units','normalized','outerposition',[0 0 1 1])
errorbar([1:length(mean_sampleSize)],mean_sampleSize,el_sampleSize)
%
```

```
alpha = 0.05;
CI = prctile(mean_sampleSize,[100*alpha/2,100*(1-alpha/2)]);
figure(14)
hist(mean_sampleSize,60);hold on
ylim= get(gca,'ylim');
h1=plot(Current_difference*[1,1],ylim,'y-','LineWidth',3,'color',[.3 .6 .9]);
h2=plot(CI(1)*[1,1],ylim,'r-','LineWidth',1);
plot(CI(2)*[1,1],ylim,'r-','LineWidth',1);
set(gca,'tickdir','out')
legend('distribution of difference','95% confidence interval','current difference'
xlabel('difference = LEA - REA')
ylabel('frequency')
title(sprintf('Boostrapping - %s \nsample size from 2 to %d\n%d times simulation e
    condition,sample_size,trials))

box off
```

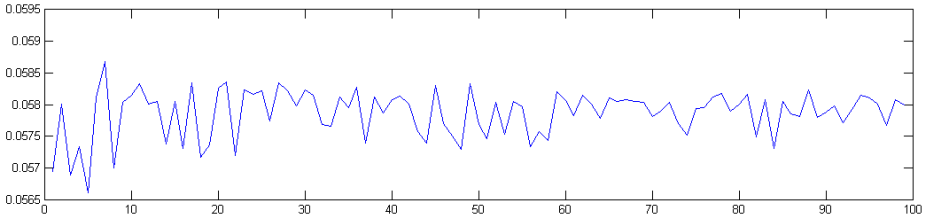


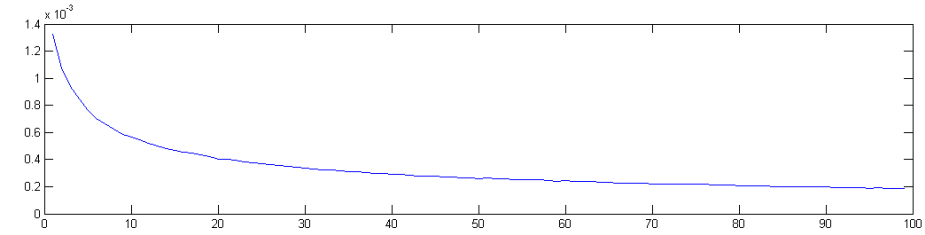


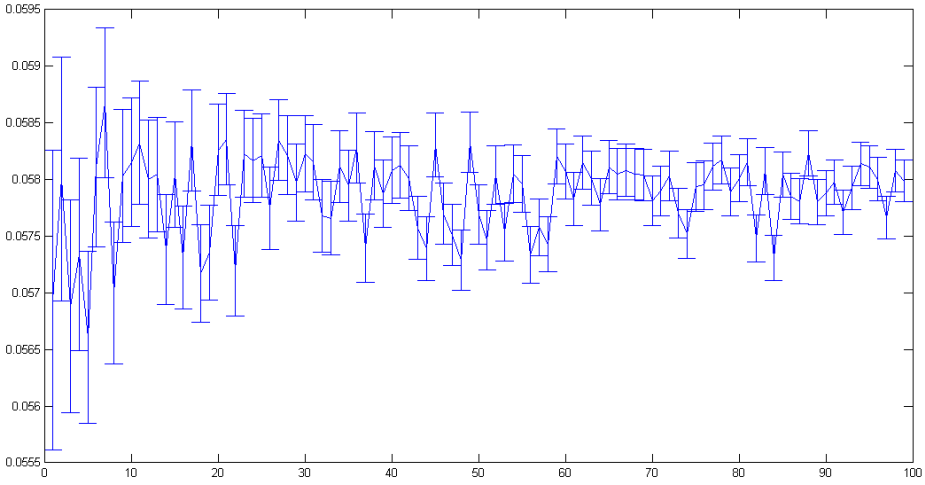
for lexical tone

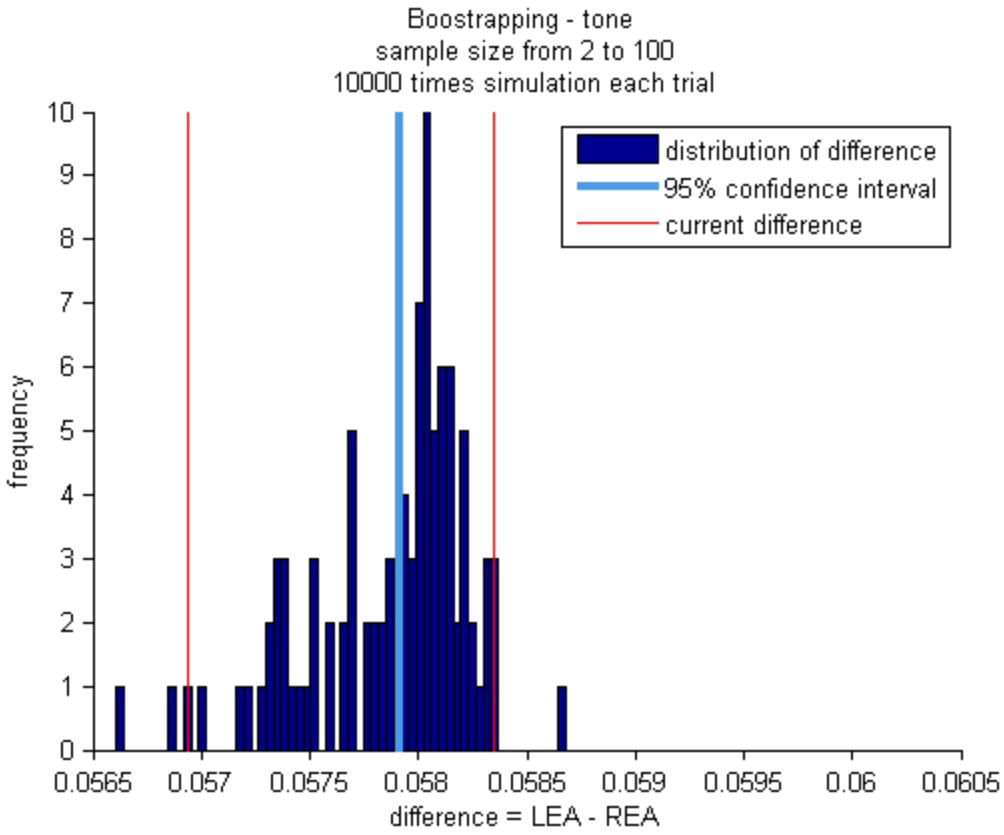
```
clear all; close all; clc
condition = 'tone';sample_size=100;trials=10000;
cd('C:\Users\ning\Dropbox\NYU\MA thesis\result2')
pool = [11:26,28,29];
file = dir(sprintf('Dichotic%sClassic*.mat',condition));
for ii = 1:length(file)
    load(file(ii).name)
    [~,Dichotic]=DichoticErrorTone_toneExcluded(Output,0,5,[]);

    result(ii,:) = [Dichotic.LEA,Dichotic.REA];
end
%
cd('C:\Users\ning\Dropbox\NYU\MA thesis\result')
pool = 1:24;
Takes = ones(1,24);
Takes([4,5,19,20]) = 0;% excluded
pool = nonzeros(pool(:) .* Takes(:));
%pool = [0;pool]';
for ii = 1:length(pool)
    file = dir((sprintf('Dichotic%sClassic_%d.mat',condition,pool(ii))));
    load(file.name)
    [~,Dichotic]=DichoticErrorTone_toneExcluded(Output,0,5,[]);
```

```
    result(ii+18,:) = [Dichotic(1).LEA,Dichotic(1).REA];
end
cd('C:\Users\ning\Dropbox\NYU\MA thesis\result2')
Current_difference = mean(result(:,1) - result(:,2));
% permutation test

for ii = 2:sample_size
    for samplingTimes = 1:trials
        samplingTimes;
        subset_pick = randsample([1:length(result)],ii,'true');
        subset_result = result(subset_pick,:);
        % (LEA - REA) / std
        differences(samplingTimes,ii-1) = ...
            mean(subset_result(:,1)-subset_result(:,2));

    end
    mean_sampleSize(ii-1) = mean(differences(:,ii-1));
    el_sampleSize(ii-1) = std(differences(:,ii-1))/sqrt(trials);
end
figure('units','normalized','outerposition',[0 0 1 1])
subplot(211)
plot(mean_sampleSize)
subplot(212)
plot(el_sampleSize)
figure('units','normalized','outerposition',[0 0 1 1])
errorbar([1:length(mean_sampleSize)],mean_sampleSize,el_sampleSize)
%
alpha = 0.05;
CI = prctile(mean_sampleSize,[100*alpha/2,100*(1-alpha/2)]);
figure(14)
hist(mean_sampleSize,60);hold on
ylim= get(gca,'ylim');
h1=plot(Current_difference*[1,1],ylim,'y-','LineWidth',3,'color',[.3 .6 .9]);
h2=plot(CI(1)*[1,1],ylim,'r-','LineWidth',1);
plot(CI(2)*[1,1],ylim,'r-','LineWidth',1);
set(gca,'tickdir','out')
legend('distribution of difference','95% confidence interval','current difference'
xlabel('difference = LEA - REA')
ylabel('frequency')
title(sprintf('Boostrapping - %s \nsample size from 2 to %d\n%d times simulation e
    condition,sample_size,trials))

box off
```


0.0595
0.059
0.0585
0.058
0.0575
0.057
0.0565
0
10
20
30
40
50
60
70
80
90
100


x 10^-3
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
10
20
30
40
50
60
70
80
90
100

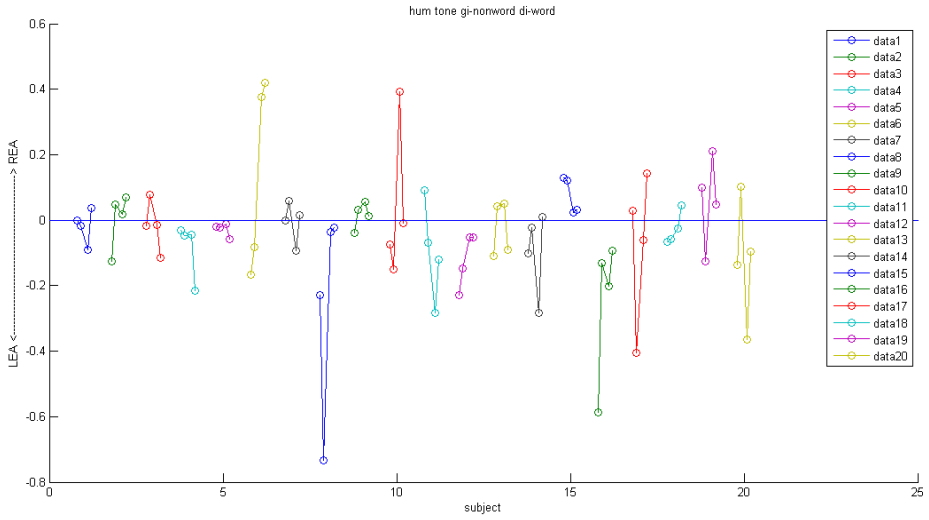

0.0595
0.059
0.0585
0.058
0.0575
0.057
0.0565
0.056
0.0555
0
10
20
30
40
50
60
70
80
90
100



individual plot

```
clear all; close all;clc
% initialize
%cd('C:\Users\ning\Dropbox\NYU\MA thesis\result2')
pool = [11:30];%17,19,21,22,23:24];
for sub = pool
    file(1,sub) = dir(sprintf('Dichotichum*%d*',sub));
    file(2,sub) = dir(sprintf('Dichotictone*%d*',sub));
    file(3,sub) = dir(sprintf('Dichoticgi*%d*',sub));
    file(4,sub) = dir(sprintf('Dichoticdi*%d*',sub));
end
figure('units','normalized','outerposition',[0 0 1 1])
soundtype={'hum','tone','gi-nonword','di-word'};
margins=[-.2 -.1 .1 .2];
result=zeros(4,2,length(pool));
for ii = 1:length(pool)
    for i = 1:4

        load(file(i,pool(ii)).name)
        [~,Dichotic]=DichoticErrorTone_toneExcluded(Output,0,5,[]);
        differences(i) = (Dichotic.LeftPOE-Dichotic.RightPOE)/...
            (Dichotic.LeftPOE+Dichotic.RightPOE);

    end
```

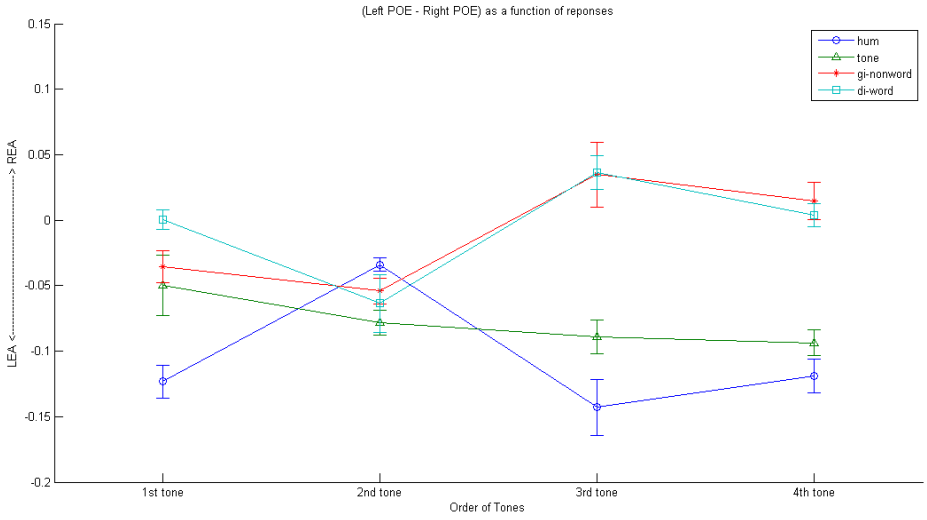
```
    pp=plot(ii+margins,differences,'o-');hold on

    hold all
end
ylabel('LEA <----------------------------------------------> REA')
xlabel('subject')
title(sprintf('hum tone gi-nonword di-word'))
set(gcf,'color','w')
legend toggle
box off
xlims = get(gca,'xlim');
line(xlims,zeros(1,2))
```



accuracy as a function of responses

```
clear all; close all;clc
% initialize
%cd('C:\Users\ning\Dropbox\NYU\MA thesis\result2')
pool = [11:30];%17,19,21,22,23:24];
for sub = pool
    file(1,sub) = dir(sprintf('Dichotichum*%d*',sub));
    file(2,sub) = dir(sprintf('Dichotictone*%d*',sub));
    file(3,sub) = dir(sprintf('Dichoticgi*%d*',sub));
    file(4,sub) = dir(sprintf('Dichoticdi*%d*',sub));
end
soundtype={'hum','tone','gi-nonword','di-word'};
markers = {'-o','-^','-*','-s'};
margins=[-.2 -.1 .1 .2];
result=zeros(length(pool),4,4);
fig=figure('units','normalized','outerposition',[0 0 1 1]);
for i = 1:4

    for ii = 1:length(pool)
```

```
            load(file(i,pool(ii)).name)
            [~,Dichotic]=DichoticErrorTone_toneExcluded(Output,0,30,[]);%regardless RT
            Permutations_response = Dichotic.LrRMat;
            for Tones = 1:4
                temp_perumtations=...
                    Permutations_response(Permutations_response(:,2) == Tones,:);
                LeftError = ...
                    sum(temp_perumtations(:,2) ~= temp_perumtations(:,1))/length(temp_
                RightError = ...
                    sum(temp_perumtations(:,2) ~= temp_perumtations(:,3))/length(temp_
                ErrorIndex = (LeftError - RightError)/(LeftError + RightError);
                result(ii,Tones,i) = ErrorIndex;
            end
        end
       mean_result(i,:) = nanmean(result(:,:,i));
       el_result(i,:) = nanstd(result(:,:,i))/(length(pool)-1);
       fig;
       errorbar(mean_result(i,:),el_result(i,:),markers{i});hold all
    end
    legend(soundtype)
    set(gca,'xtick',[1:4],'xticklabel',{'1st tone','2nd tone','3rd tone','4th tone'})
    xlabel('Order of Tones')
    ylabel('LEA <---------------------------------------------> REA')
    title('(Left POE - Right POE) as a function of reponses')
    set(gcf,'color','w')
    box off
```



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