

CV \*

## An Acoustical Study of English CV Syllables

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## ABSTRACT

This study examined acoustic characteristics of 900 CV syllables produced by five English native speakers. Those target syllables were produced between the syllable /ba/ twenty times. The syllables were segmented and normalized by the maximum intensity value of each syllable and were divided into consonant or vowel sections by a few visible acoustic criteria. Intensity values were collected at 100 relative time points per syllable. Also, cumulative intensity values and consonant and vowel durations along with the ratio of a consonant to each syllable were measured using Praat scripts. Results showed as follows: Firstly, the consonantal section amounted to a quarter of the syllable in terms of both the cumulative intensity and duration. Secondly, the consonantal ratio by the cumulative intensity was similar to that by the duration. Finally, the sum of the cumulative intensity values in each syllable partially coincided with the consonant order by the current sonority scale. Further studies would be desirable on more reliable acoustical measurements and sophisticated perceptual experiments on the English syllables.

**Keywords :** English syllable, acoustical study, temporal organization, sonority scale

## 1.

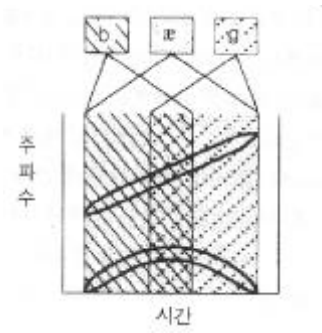
,  
(Ladefoged, 2001).

( , 2003). , Han(1999)  
가 , Yang(2002)  
, Seo (2005; 2006)

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\*  
\*\*

(2 )



1.

Lee & Kim(2005)

tense/lax

s+  
, Yun(2004) a+C+a

가

가

가

가

가 . < 1> Liberman

( , 2000:299, 8.5 ).

Gigerich(1992:133) Bat-El(1996)

(sonority scale)

< < <

가

/l, m/

/p, t/

가

가

가

CV

1.

가?

2.

가?

3.

가?

5

2.

2.1

Patel, Loefqvist Naito(1999)가

(<http://www.nsi.edu/>)

users/patel/download.html)

2 , 5 . 6 , 가 (lk)  
ba da 가

10 kHz

C+/a/ (pa) /ba/  
(ba pa ba pa ba pa ba pa ba)

9 가 (cha, ha, sa, ya, la, ma, ba, pa, ta)가

File

Extract sound selection(time from 0)

Sound untitled

< 1>

100 ms

, 100 ms (start)

(end)

(Scale peak... 0.99),

900

(5 X 20 X 9 )

2.2

< 2>

가

가 가

CV

, 100

가

. 100

Pulse

(\*ba, cha, ha, pa, sa, ta - \*ba sc 가 VOT가 -43 ms,

-66 ms

가

가 가

(la, ma, ya) a

< 2> A

가 가

(Move cursor to nearest zero crossing)

a

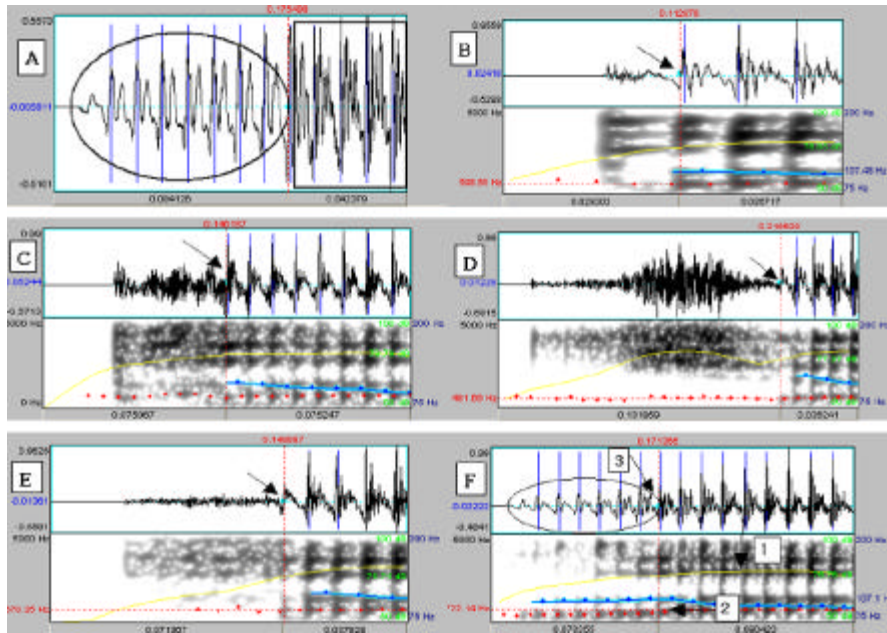
가 가

a

(< 2> F 1 ), , a

F1 (< 2> F 2 )

a



2.

, ba(< 2> B) pa(< 2> C) +  
 가 , 가 가  
 . cha(< 2> D)  
 가  
 sa ,  
 가 가  
 . ha(< 2> E)  
 h가 가  
 . la(< 2> F) (1 ) ,  
 1000 Hz 1 , 50 dB  
 F1 a (2 ) 가 3  
 a  
 (3 ) . ma ya

, 100

SPSS 12.0K

3.

3.1

< 1>

1. ( : dB)

				(%)		
<b>ba</b>	530	7400	7930	6.7	79.3	5.2
<b>ta</b>	1685	6025	7710	22.0	77.1	5.9
<b>pa</b>	1713	6030	7743	22.2	77.4	5.9
<b>ha</b>	1763	5784	7547	23.5	75.4	8.1
<b>cha</b>	1989	5726	7715	25.9	77.1	6.4
<b>ma</b>	2003	5886	7889	25.4	78.9	4.9
<b>la</b>	2062	5860	7922	26.1	79.2	5.0
<b>sa</b>	2102	5283	7386	28.6	73.8	9.5
<b>ya</b>	2542	5314	7855	32.4	78.5	5.1

< 1>

sa 73.8 dB    ba 79.3 dB    6 dB

,  
 . < 1>    ba 6.7%    ya 32.4%  
 23.7%    ba    25.8%

4    1

가    100

100    , ba    5    20    ,    6.2 dB

100    10,000    79.4 dB    ,    79.3 dB    가

. ba    < 1>    79.3 dB    가  
 5.2 dB    가

가 , 가 , 가 100  
 가 , 가 , 가

3.2

< 2>

2. ( ms)

				(%)
ba	15	207	222	7.0
ta	54	192	245	23.6
pa	54	187	241	23.9
la	66	191	256	26.4
ha	66	182	247	27.0
cha	69	195	264	27.2
ma	70	199	269	26.1
ya	80	175	255	32.5
sa	99	202	300	33.1

< 2> ba 222 ms sa 300 ms  
 , 256 ms , 64 ms ,  
 ba가 가 , sa가 가 a

가  
 25.2% , 가 ba 27.2%가  
 4 1 . < 1> < 2>

< 3>

< 3>

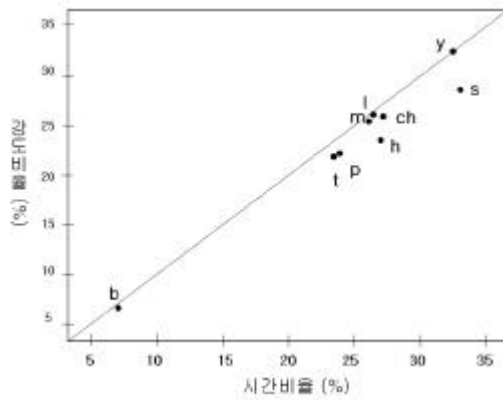
SPSS

r=0.98

100  
 가  
 sa(4.5%)가 가 , ha가 3.5% ,  
 가 , ya  
 0.1% , ba la ma 1%

가

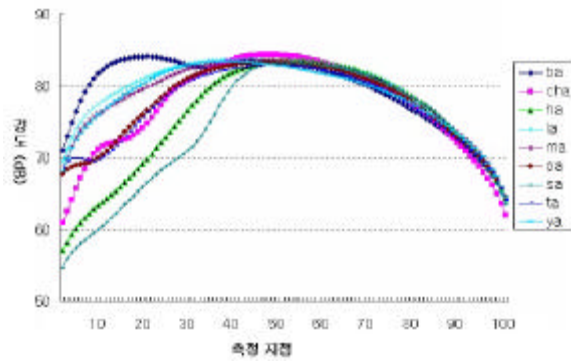
pa, ta, cha 1.4% 1.7%



3.

3.4

5  
 < 4> 5 20 100



4.

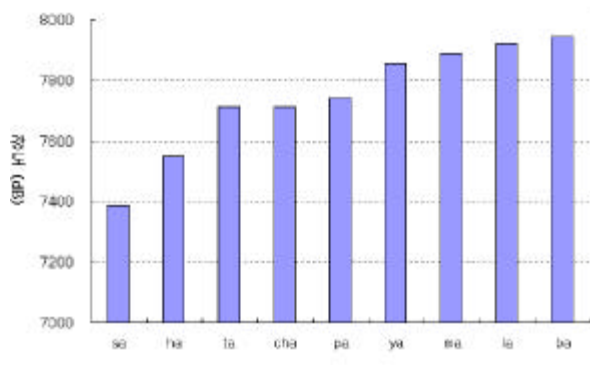
< 4> 45 100 a  
 , ha sa가 가 45  
 pa, ta, cha  
 , la, ya, ma가 ba

lc                    ap            10            16  
25                    가

a

100

. < 5> < 1>



5.

< 5>

(sa, ha, ta, cha, pa)

(ya, ma, la, ba)

Gigerich(1992)

가 ,

<

ba

가

ma

ya

a

7620 dB

7903 dB

가 283 dB

가

sa

가

ba

559 dB

가

3500 Hz

가

( , 1997), sa

ta pa

가

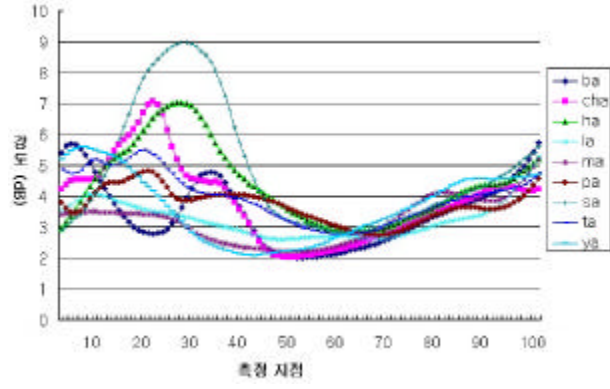
, Han(1999)

<

< , ,

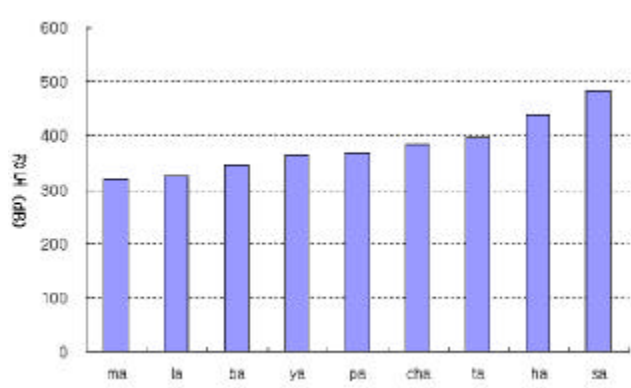


< 6 >



6.

100 3.8 dB < 6 >  
 42 79 3 dB  
 4 >  
 100  
 < 7 >  
 < 5 >  
 339 dB 가 414 dB 가 75 dB 163  
 dB 가 가 sa 가 ma  
 가 가 가



7.

4.

5 CV

가 ba 가 sa 1/4  
가 가 가 가 가 가  
가 가 가 가 가 가

2000.  
1997. “ ” 2, 125- 134.  
2003. “ ” 10(2), 237- 248.  
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&lt; &gt;

**1.**

```

loop$="1"
for i from 1 to 5
  k=6-'i'
  select Sound untitled
    name$="loop$"+"k"
    Rename... 'name$'
endfor
folder$="apdata"
filename$="apba"
Create Sound... start 0 0.1 10000 0
Create Sound... end 0 0.1 10000 0
for i from 1 to 5
  loopi$="loop$"+"i"
  select Sound start
    Copy... start
  select Sound 'loopi$'
    Copy... 'loopi$'
  select Sound end
    Copy... end
  select Sound start
    plus Sound 'loopi$'
  plus Sound end
  Concatenate
  select Sound chain
    Play
    Scale peak... 0.99
  save$="filename$"+"loopi$"
  Write to WAV file... C:\syllable\folder$\save$.wav
  select Sound 'loopi$'
    Remove
  select Sound start
    Remove
  select Sound end
    Remove
  select Sound chain
    Remove
endfor
select all
  Remove

```

**2. CV**

```

form Subject and Syllable names?
  word subj ap
  word syllable ba
endform
folder$="subj$"+"data"
name$="subj$"+"syllable$"
abs$="subj$"+"syllable$"+"abs"
Create Table with column names... dblink 100 11 12 13 14 15 21 22 23 24 25
!          31 32 33 34 35 41 42 43 44 45
Create Table with column names... abs 10 Value 11 12 13 14 15 21 22 23 24 25

```

```

!          31 32 33 34 35 41 42 43 44 45
Set string value... 1 Value durC
Set string value... 2 Value durV
Set string value... 3 Value durCV
Set string value... 4 Value durRatio
Set string value... 5 Value dbC
Set string value... 6 Value dbV
Set string value... 7 Value dbCV
Set string value... 8 Value dbRatio
Set string value... 9 Value dbmean
Set string value... 10 Value dbsd
r=1
for s from 1 to 4
s11='s'*10+1
s15='s11'+4
for i from 's11' to 's15'
filename$="name$"+"i"+".wav"
soundname$="name$"+"i"
Read from file... C:\syllable\folder$\filename$
select Sound 'soundname$'
dur=Get duration
start=0.1
end=dur-0.1
syldur=dur-0.2
To Intensity... 100 0 yes
Rename... dB
dbmean=Get mean... 0.1 'end' dB
dbsd=Get standard deviation... 0.1 'end'
select Sound 'soundname$'
Edit
editor Sound 'soundname$'
pause
Move cursor to nearest zero crossing
div=Get cursor
onsetdur='div'-0.1
voweldur='syldur'-'onsetdur'
endeditor
select Sound 'soundname$'
ratio=(onsetdur/syldur)*100
select Intensity dB
syldur=syldur/100
divnum=round((onsetdur/syldur)*100)
vowelno=100-divnum
onsetdb=0
for p from 1 to divnum
timer='p'*syldur+0.1
select Intensity dB
db=Get value at time... 'timer' Cubic
onsetdb='onsetdb'+db'
select Table dbline
Set numeric value... 'p' 'i' 'db'
endfor
voweldb=0
for q from divnum+1 to 100
timer='q'*syldur+0.1
select Intensity dB
db=Get value at time... 'timer' Cubic

```

```
    voweldb='voweldb'+db'
select Table dbline
    Set numeric value... 'q' 'i' 'db'
endfor
    syldb='onsetdb'+voweldb'
    dbratio=(onsetdb/'syldb')*100
select Table abs
    Set numeric value... 1 'i' 'onsetdur'
    Set numeric value... 2 'i' 'voweldur'
    Set numeric value... 3 'i' 'syldur'
    Set numeric value... 4 'i' 'sylratio'
    Set numeric value... 5 'i' 'onsetdb'
    Set numeric value... 6 'i' 'voweldb'
    Set numeric value... 7 'i' 'syldb'
    Set numeric value... 8 'i' 'dbratio'
    Set numeric value... 9 'i' 'dbmean'
    Set numeric value... 10 'i' 'dbsd'
select Intensity dB
    Remove
endfor
endfor
select Table dbline
    Write to table file... C:\syllable\'name$.Table
select Table abs
    Write to table file... C:\syllable\'abs$.Table
```