

(F₀)

1

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Charissa R. Lansing (F₀)
1996, 1, 150-176. 가 (F₀)
(F₀) 80 CID 960 B-E
가 F₀, F₀

I.

Jeffers and Barley (1971) (speechreading)
" (p. 4)

Risberg and Lubker (1978) 가
(:)

¹ 가 University of Illinois at Urbana-Champaign
(1996)

(F₀)

(unknown question) 37.9% . Bernstein, Eberhardt, and Demorest
 (1989) (identifi-
 cation task) 60% 76% . Hnath-Chisolm and Kishon-Rabin
 (1988) 가
 . 가 , Bernstein, Demorest,
 Coulter, and O'Connell (1991)
 89.3%

(fundamental frequency, F₀)

(speech perception)가 (Boothroyd, 1988; Boothroyd,
 Hnath-Chisolm, Hanin & Kishon-Rabin, 1988; Breeuwer & Plomp, 1986; Grant, Ardell, Kuhl
 & Sparks, 1985; Hnath-Chisolm & Boothroyd, 1992; Risberg & Lubker, 1978; Rosen,
 Fourcin & Moore, 1981). 가 (Kent & Read,
 1992) . Boothroyd (1988) , “ , ,
 , ; ; , , ,
 (p. 313)” .
 : ; (vowel duration); , , ;
 ; (Boothroyd, 1988; O'Shaughnessy, 1979).
 Rosen et al.(1981) (laryngograph)

(impedance)

(speechreader)가 가
 (connected discourse tracking, CDT)

가 2.5 .
 Grant et al.(1985) CDT
 (prosodic information) .
 (intensity- modulated) 가 (77.2%)
 , (amplitude envelope) 67.9%,
 67.9% , 41.1%

Boothroyd (1988) 8 (perception
 of speech pattern contrasts) . 8 350Hz
 (octave) 48dB low-pass (filtered) F₀ . ,

, F_0 98%, 97%, 80% , 가
 (94%, 97%, 86%). , ,
 , (90%, 95%, 83%), F_0 가
 (90%, 96%, 86%).

(continuance)

가 F_0 (enhancement effect)
 Boothroyd et al.(1988) Electroglottograph (EGG)
 가 F_0 가 350Hz
 48dB EGG
 25% 30% , EGG 가
 65% 75% . EGG 7.4%
 가
 (vibrotactile sensory aid)
 (Boothroyd & Hnath-Chisolm, 1988; Fourcin & Rosen, 1979; Grant et al.,
 1986; Moore et al., 1984). , Rosen and Fourcin (Moore, 1986)
 , (auditory sensory aid) (sinusoids) F_0
 . Fourcin and Rosen (1979) F_0 가
 가 . Boothroyd
 and Hnath-Chisolm (1988) F_0

가 F_0
 , Hnath-Chisolm and Boothroyd (1992) Waldstein
 and Boothroyd (1994, 1995) (3-6),
 (7-10), (11-14)
 . Hnath-Chisolm and Boothroyd (1992) ,
 12 45%, 32%,
 27% . , EGG ,
 , 72% . Waldstein and Boothroyd
 (1994) Hnath-Chisolm and Boothroyd (1992) .
 + EGG , ,
 74.2%, 66.6%, 69.5%, + F_0 가

(F₀)

71.7%, 63.9%, 64.4%

(, = 59.0%, = 48.5%, = 42.0%)

(, = 46.1%, = 35.8%, = 28.0%)

가 , F₀

가 . Lesner

(1988) , “ 가

가 , 가 (p.

89)” , Kricos and Lesner (1982)

viseme (, , ‘ㅁ’ ‘ㄹ’ viseme) 가 viseme (consonantal context)

2 Montgomery, Walden, and Prosek (1987)

가 . F₀

가 (

1) Demorest, Bernstein, and Eberhardt (1987)

. F₀ 가 4

Eberhardt et al.(1990) Demorest et al.(1987)

Eberhardt et al.(1990) (1.94%) (1.44%)

F₀ 가 가 ,

(voice pitch)

, F₀ 가

. Boothroyd and Hnath-Chisolm (1988)

F₀ ,

. Boothroyd et al.(1988) Boothroyd and Hnath-Chisolm (1988) F₀

가 F₀

가 , F₀

가

. Breeuwer and Plomp (1986) ,
(amplitude)

(29.0%) Risberg and Lubker (1978) (4.5%)

. F₀ CUNY Topic Related Everyday
Sentences (Boothroyd & Hnath, 1986, 1988; Boothroyd et al., 1988; Hnath-
Chisolm & Boothroyd, 1992; Waldstein & Boothroyd, 1994, 1995). CUNY
Hnath-Chisolm and Boothroyd (1992) Waldstein and Boothroyd (1994, 1995) F₀

3 14 102

가 Bernstein and Eberhardt (1986a, 1986b)가 1568

B-E

F₀

F₀

가(gain)가 Boothroyd and Hnath-Chisolm
(1988) (follow-up) , F₀

F₀

F₀ 85%

가가

(1) F₀

, (2) F₀

가

(3)

F₀

가

가

가

Waldstein and Boothroyd (1994, 1995)

Waldstein and Boothroyd가 topic related CUNY

unrelated B-E

가

follow-up

II.

1.

가 27
 25dB HL (re: ANSI- 1989] at 250, 500, 1000, 4000 &
 8000Hz)
 20 Central
 Institute for the Deaf (CID) (Davis & Silverman, 1970)
 37.66% 가
 Eberhardt et al.(1990)

2.

2 (Bernstein & Eberhardt,
 1986a, b) (Pioneer laservision player LD-V8000)
 65cm 14-inch (IBM Personal System/2
 Color Display monitor) EGG
 , EGG (Crown D-75 amplifier and Yamaha mixer
 MV802) 65cm 가
 6cm (Celestion and ST compact)

3.

가.

80 CID 960 B-E
 1040 open-set unrelated
 가
 (session)(,) - (EGG

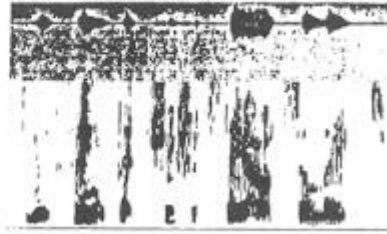
) (pre-testing) · (post-testing) 40 CID (20)
 960 1 16 가
 , 30 2
 30 (3-6),
 (7-9), (10-12)

, F_0 가 가
 (Hnath-Chisolm & Boothroyd, 1992, p. 1162) EGG 350Hz
 24dB low-pass . < -1> (broadband
 waveform) (spectrogram)
 72dB SPL

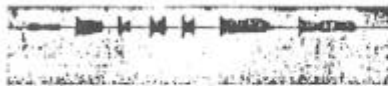
(a) 남성 화자의 여파시키지 않은 음파 모양



(c) 여성 화자의 여파시키지 않은 음파 모양



(b) 남성 화자의 여파시킨 음파 모양



(d) 여성 화자의 여파시킨 음파 모양



< -1> “Do you think that she should stay out so late?”
 (spectrogram)

4 .

가.

Eberhardt et al.(1990)

가

가 (enter key)

가

가

F₀ 가

(counterbalanced). < -2>

가 19 가

()

F₀

feedback 80 CID (40)

4 ((block)) 3

720 B-E , 689

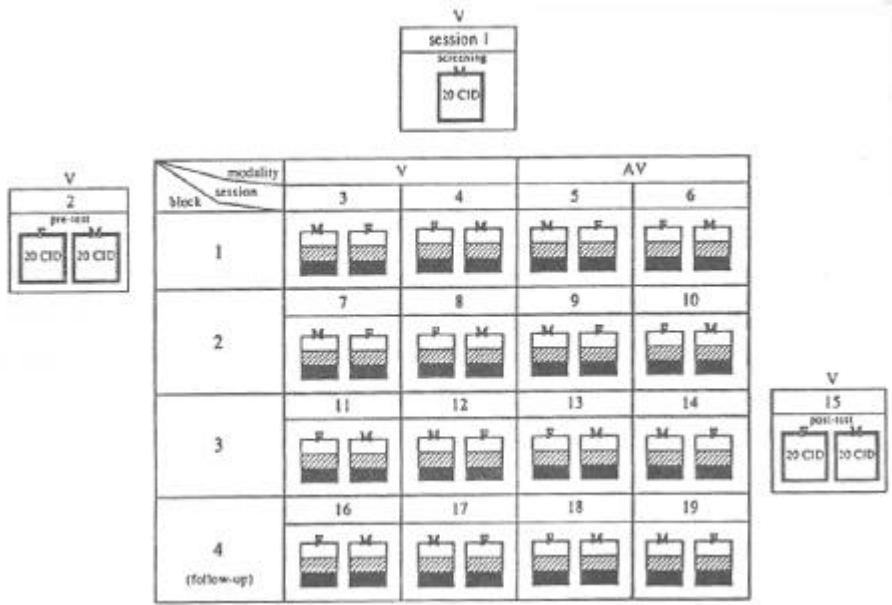
31

가

feedback

4 가 240 B-E

F₀ 가



< -2 >

(V= ; AV= - . M= ; F= . 20 CID = feedback CID ; = feedback 10 , , 30 B-E)

III.

1. (Quantitative Analysis)

가. 960 가 , (word correct scores) 가 (weighted percentages) , 가

(F₀)

. < -1>

가

가 2(/ -) × 2(/) × 3
(/ /) × 4() (分散分析)(multifactorial analysis of
variance) . < -2> , (factor)

가 (p < .005) . ,

- , - (two- , three- , four- way - interactions)

(p > .05). 16 , , ,

가 .

(1)

[t (158)=17.19, p < .001] F₀

34.65% 가 .

(2)

가 (M=52.91, SD=34.81) 가
(M=45.98, SD=36.28) 가

. < -3> , 4
가 .

(3)

< -4> , 가 2, 3, 4 가

, 1, 3, 4 가 .

1 가 , 2 가 . t-test

가 [t (638)=2.89, p =.004]

[t (638) = 1.01, p > .05]

[t (638) = 1.90, p > .05] 가 .

, 가 .

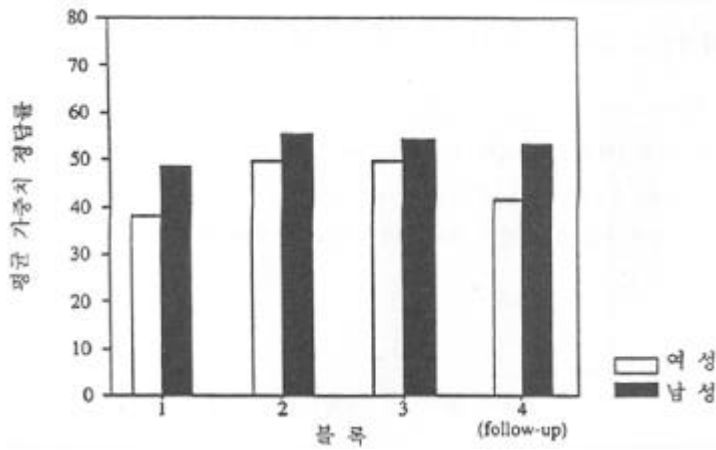
modality block session	V				AV			
	3		4		5		6	
1	M	F	F	M	M	F	F	M
	33.74 (29.53)	13.70 (15.97)	31.74 (33.47)	29.62 (33.13)	67.09 (29.33)	52.44 (34.10)	55.41 (34.19)	62.84 (35.26)
Total session M (SD)	23.72 (22.75)		30.68 (33.30)		59.77 (31.72)		59.13 (34.73)	
Total m/b M (SD)	27.20 (28.03)				59.45 (33.23)			
2	7		8		9		10	
	M	F	F	M	M	F	F	M
	48.05 (33.10)	31.77 (37.40)	31.70 (29.61)	30.61 (31.74)	78.80 (24.36)	64.17 (34.33)	69.34 (27.55)	64.93 (30.07)
Total session M (SD)	39.91 (35.25)		31.16 (30.68)		71.49 (29.35)		67.14 (28.81)	
Total m/b M (SD)	35.54 (32.97)				69.32 (29.08)			
3	11		12		13		14	
	F	M	M	F	F	M	M	F
	26.51 (24.97)	36.52 (27.18)	40.23 (33.06)	28.86 (24.84)	67.12 (31.26)	75.88 (33.00)	63.65 (33.44)	75.74 (36.26)
Total session M (SD)	31.52 (26.08)		34.55 (28.95)		71.50 (32.13)		69.70 (34.85)	
Total m/b M (SD)	33.04 (27.52)				70.60 (33.49)			
4 (follow-up)	16		17		18		19	
	F	M	M	F	F	M	M	F
	31.80 (30.84)	41.65 (29.88)	38.19 (29.39)	19.22 (21.06)	69.48 (31.33)	76.56 (26.65)	58.19 (33.54)	66.71 (33.48)
Total session M (SD)	36.73 (30.36)		28.71 (25.23)		73.02 (28.99)		62.45 (33.51)	
Total m/b M (SD)	32.72 (27.80)				67.74 (31.25)			
Total modality M(SD)	32.13 (30.14)				66.78 (32.27)			
Total M (SD)	49.46 (31.21)							

(= 가 ; () = . m/b=modality/
 V= ; AV= . M= ; F=)

< -2>

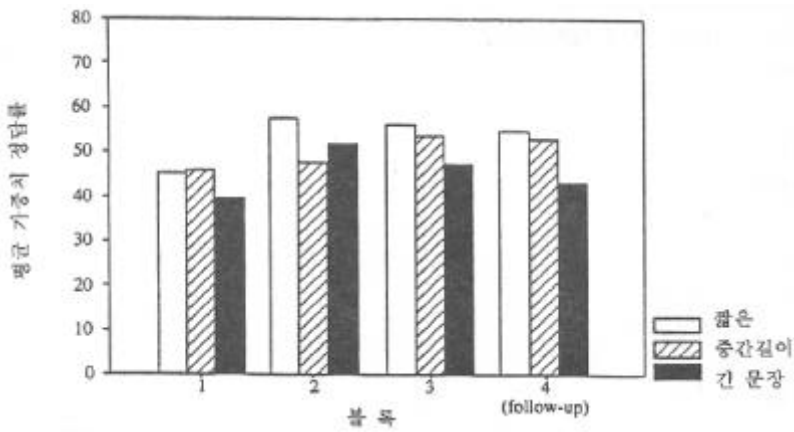
				(df)	<i>F</i>
				1	307.219*
				1	12.279*
				2	5.772*
				3	4.483*
×				1	3.109
×				2	20.965
×				3	0.325
×				2	1.955
×				3	0.333
×				6	1.039
×	×			2	0.483
×	×			3	1.053
×		×			1.033
×		×			1.907
×	×		×	6	1.236
				912	(0.094)

((mean square errors) , * $p < .005$)



< -3>

가



< -4>

가

(4)

< -5>

, 1 가 , 2 가

가 가 1

: 1 2 [t (478)=-2.80, p=0.005]; 1 3 [t (478)=-2.60, p=0.010]; 1 4 [t (478)=-2.15, p=0.032]. 가 가 1

2

對 -

(1) -
 가 , (2) modality
 () modality (-)
 , (3) -
 가 .

(1)
 가 2(/) × 3(/ /) × 4()
 . < -3> , ,
 [F (1,456)=15.28, p<.01] [F (2,456)=4.17, p<.05], ×
 × [F (6,456)=2.43, p<.05] .

< -3> 가

	(df)	F
	1	15.284*
	2	4.171*
	3	1.739
×	2	1.093
×	3	0.306
×	6	1.429
× ×	6	2.431*
	456	(0.085)

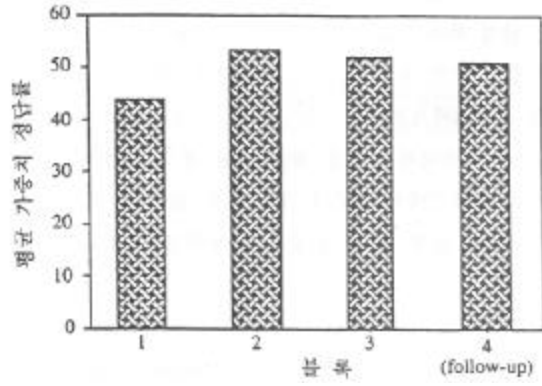
((mean square errors) , * p<.05)
 < -6> , (M=37.33, SD=31.18)
 (M=26.91, SD=28.36) .

< -7> , 1, 3, 4 가
 , 2, 3 , 1 4 가
 . [t (318)=

2.48, $p=0.14$],

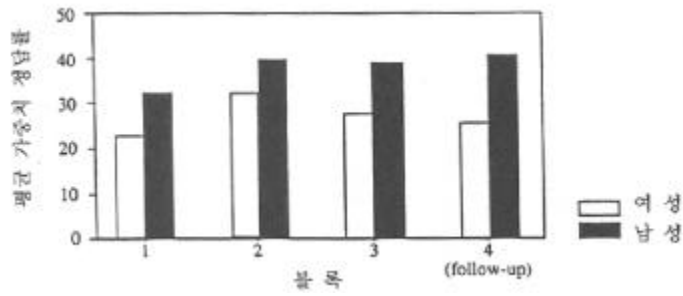
[$t(318)=-2.63, p=0.009$]

가



< -5>

가

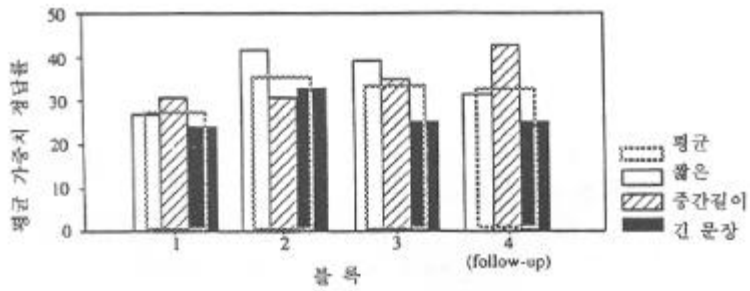


< -6>

(n=240)

(n=240)

가



< -7>

(n=160),

(n=160)

() (n=160),

가

(F₀)

< -4> × × 가
 , , ; 2 3 , ,
 ; 4 , , .
 가 , 1 2 , ,
 ; 3 , , ; 4
 , , 가 .

(2) -

< -5> , - ,
 [F (3,456)=2.956, p<.05]. < -8> 가 가 3, 2,
 4, 1 . t-test , 1
 2 [t (238)=- 2.42, p=.016] , 1 3 [t (238)=- 2.58, p=.01] , 가
 가 1 2 가 .

< -4> x x 가

1	31.00 (31.81)	41.02 (39.35)	23.03 (16.96)	23.58 (28.64)	20.10 (30.39)	24.48 (24.52)
2	53.17 (40.01)	34.98 (30.18)	29.84 (24.92)	31.75 (39.55)	27.43 (28.67)	36.03 (32.37)
3	50.90 (37.50)	38.34 (20.17)	25.87 (25.77)	26.83 (27.21)	31.32 (26.49)	24.90 (20.79)
4	29.00 (29.33)	52.94 (30.79)	37.82 (23.96)	32.67 (28.66)	32.39 (31.83)	11.47 (10.39)

() .

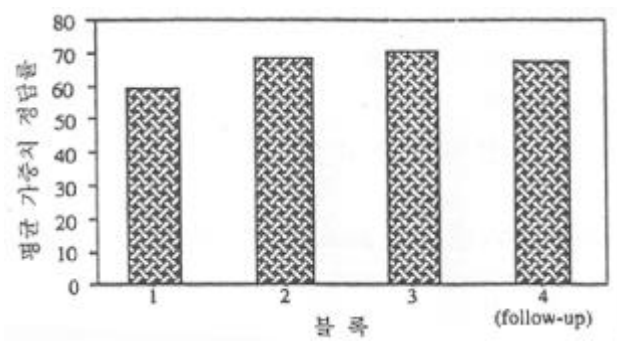
2() × 1() (.) [F
 (1,76)= 2.85, p>.05], [F (1,76)=2.01, p>.05], × [F (1,76)=
 1.89, p>.05] ()
 -) 가가

< -5>

가

				(df)	F
				1	1.387
				2	2.702
				3	2.956*
×				2	1.320
×				3	1.015
	×			6	0.709
×		×		6	0.857
				456	(0.102)

((mean square errors) , * $p < .05$)



< -8>

가

2. (Qualitative Analysis)

가

가

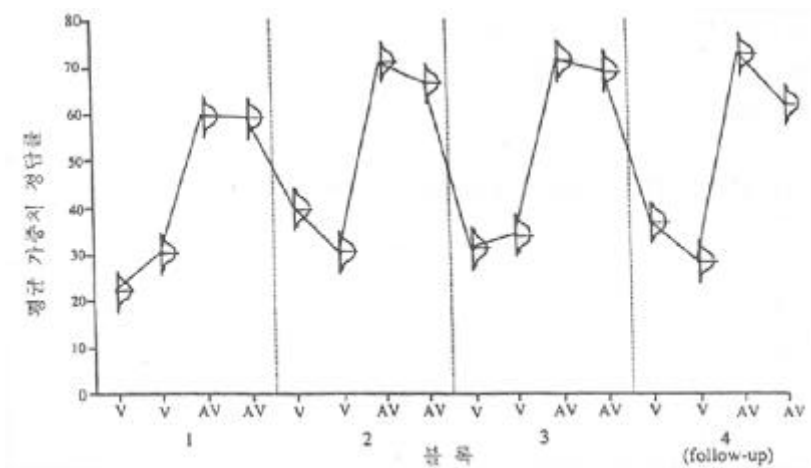
가

가.

< -9>

1

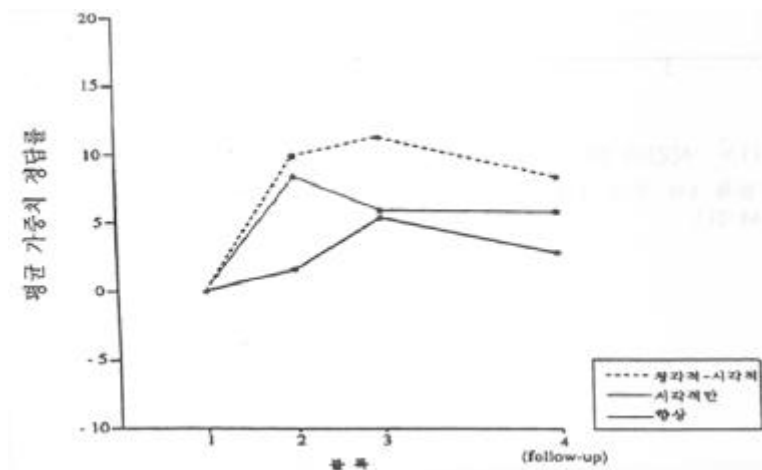
가



< -9> 16

(∇ = V ; AV =)

< -10> , 가
 2 가 가 . 가 가(8.3%) 1 2 ,
 3 4 (0.3%)가 - , 가
 3 가 가 . - , 가
 가(9.9%) 1 2 . 3 가 가
 , 가 가(11.2%) 1 3 .



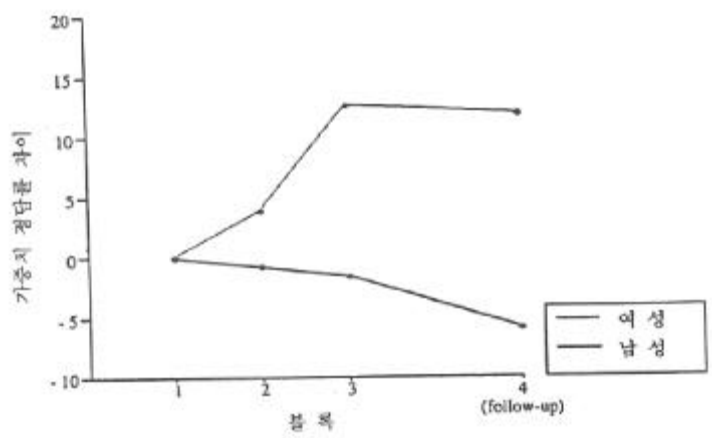
< -10>

(가; $\frac{1}{1}$ =) - (가; $\frac{1}{1}$ = [() - ()] - (M=0).)

< -11>

가 가
가 가
가

가 (3.9%)

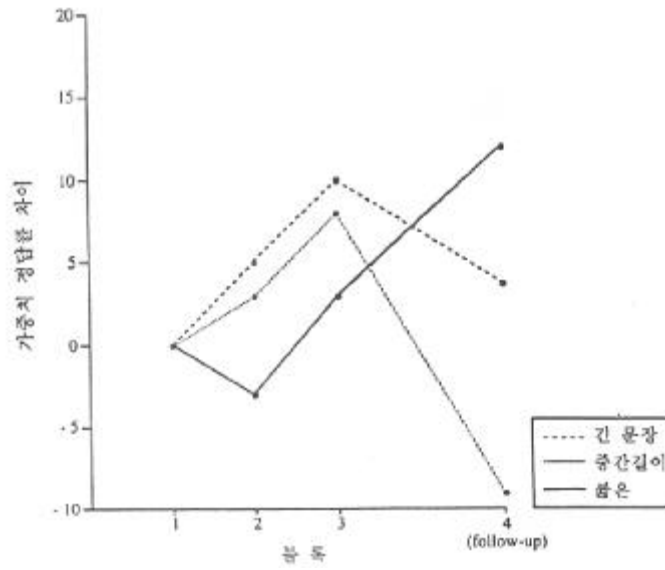


< -11>

가

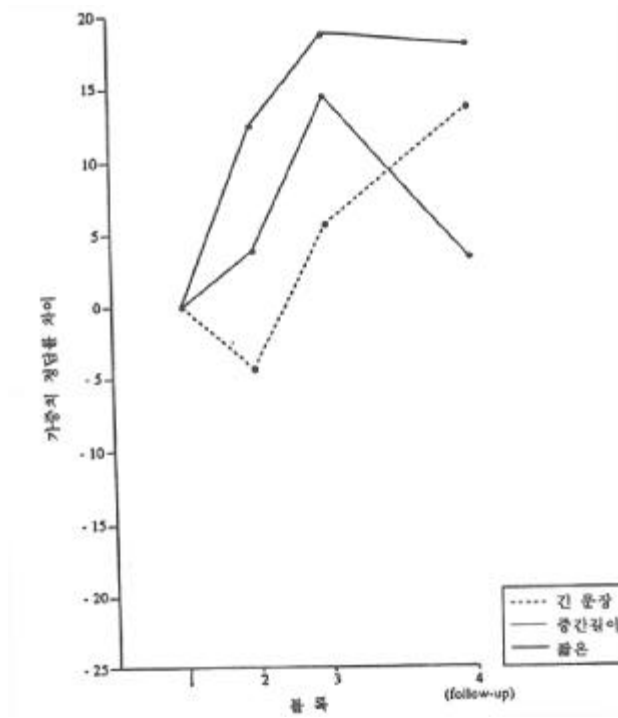
(가; $\frac{1}{1}$ 가 [() - ()] - (M=0).)

(F₀)



< -12> 가
 (1 (M=0).)

< -12> .
 2 가 가 . 3
 가 가 . (-) 4 가가 3 17%
 . 3 가 가 .
 2 가 1 .
 2 3 가 1 , 4 가
 가 1 . 가 1 .

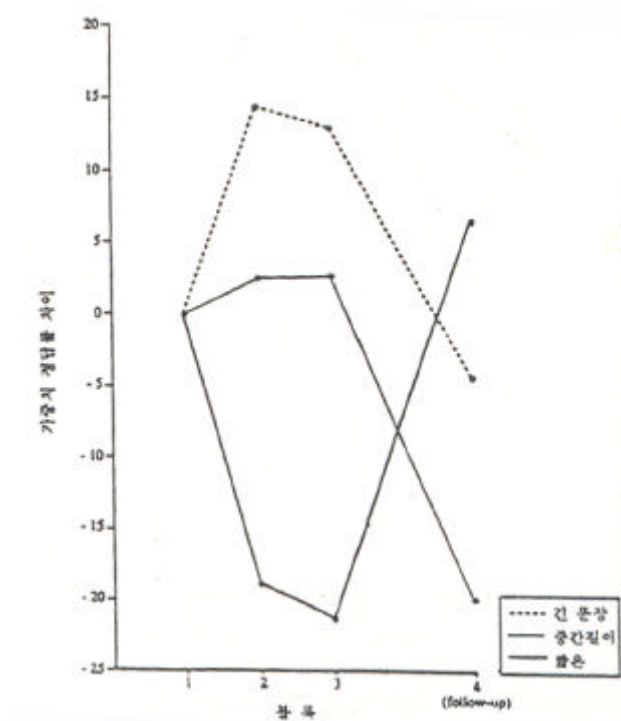


< -13> 가 (1 가 (M=0.) 가

< -13> 가
 3 가 가 가
 가 3 가 가 2
 가 3 4 가 가 , 2
 1 ,
 1 2, 3, 4 가 .

< -14>
 1 3 21.2% 가
 1 6.6% 가 가 1 가 2
 3 가 가 4 22.4% .
 2 14.4% 가 3 13% 가 4 17.2%

2 3 가 가 4



< -14 > (1 가 (M=0.) 가

IV.

1. F₀

960 B-E

F₀ 가

-

. F₀

4

3

1

2 . F₀ 가

(segmental and suprasegmental cue)

F₀ 가

(speech sound onset), (offset) (duration)
 F_0 (segmental voicing distinction)
 F_0 (Lehiste, 1970).
 F_0

2.

CUNY Topic-Related Everyday Sentences
 가 F_0
 가 F_0
 CUNY (Hnath-Chisolm & Bootyroyd, 1992; Waldstein & Bootyroyd, 1994, 1995).
 가 , 가 , Hnath-Chisolm and Boothroyd (1992) “ F_0 contour가 contour” (p. 1164).
 1, 3, 4 가 , [t (318)=2.48, $p=0.014$] [t (318)=-2.63, $p=0.009$]
 가 가 , 가 F_0 F_0
 , CUNY
 Waldstein and Boothroyd (1994) , 34.0% ($SD=15.3$)
 , 68.4% ($SD=13.7$)
 ($M=32.1$, $SD=30.1$) - ($M=66.8$, $SD=32.3$)
 가 Waldstein and Boothroyd (1994)
 46.1%, 35.8%, 28.0%,
 74.2%, 66.6%

69.5%
 34.9%, 71.4%, 34.8%, 65.6%, 26.7%, 63.3%

Waldstein and Boothroyd (1994)

가

37.66% Eberhardt et al.(1990)

가 Waldstein and Boothroyd (1994)
 (34.0%)

3.

F₀ 가 . B-E 가
 Demorest et al.(1987) Eberhardt et al.(1990) 가
 가 , 가 가 , 가 , 가 , 가 F₀
 가 F₀ 가 , 가 가 F₀
 2 가 , 가 F₀
 가 18.7%, 14.5%, 13.6% , 가
 가 , 1 3 21.2%
 , 1 4 6.6% 가 가 F₀
 1 3 2.4% 가 , 1 4
 19.9% 가 F₀ 1 2

14.4% 가 , 1 4 4.1% . , 가
 F_0 , 가 가

4 .

, F_0
 3 , 1 2
 ,
 F_0 1 2, 3, 4 가 .
 가 1 2, 3, 4 , F_0
 가 , 가
 , 가 , ,

5 .

가
 ,
 가 (sentence list equivalence) (single subject
 study) 가 ,
 가 가

Eberhardt et al.(1990) , 15

(가) 가
 . Bernstein et al.(1991) 가

(F₀)

가 ,

가

가

(Barlow, Hayes & Nelson, 1984). Barlow et

al.(1984) ,

(time-series analysis)

· , Boothroyd and Hnath-

Chisolm (1988) F₀

(time-

series methodology)(Barlow et al., 1984)

가 (factor)

가

가

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