The Deletion of the Glide *y* in Seoul Korean: Toward its Explanations*

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This paper examines *y* deletion in Seoul Korean on a large sociolinguistic database. It first shows that Seoul Korean has two distinct processes *y* deletion: categorical *y* deletion, which occurs after a palatal consonant, and variable *y* deletion occurring only before the vowel *e*. The first part of this paper examines variable *y* deletion. The examination of the process reveals that it is conditioned by such internal factors as the existence of a preceding consonant, the nature of the preceding consonant, and word-internal position where *y* occurs, i.e., whether *y* appears in the word-initial or non-word-initial syllable. This process is also affected by external factors such as the speech style, social class, and age of the speaker. The difference in the deletion rate of *y* among the three age groups (and among the social class groups, additionally) is taken to suggest that *y* deletion before *e*, i.e., monophthongization of *ye* to *e*, is a change in progress. This paper then attempts a phonological account of two different process of *y* deletion, proposing two OCP (coronal) constraints. The two constraints are proposed as having rather different strengths: the stronger one triggers categorical deletion and the weaker, variable deletion. A phonetic explanation of the ongoing *y* deletion change is also attempted. It is shown that *ye* has the shortest perceptual distance between its component segments among all *y* diphthongs of Seoul Korean. It is suggested that a relative lack of perceptual distinction between the two segments of the diphthong *ye* is responsible for the ongoing loss of *y* in this diphthongal sequence.

1. Introduction

Though the deletion of *w* in Korean has been carefully examined through

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such sociolinguistic variation studies as Silva (1991) and Kang (1996a), the nature of *y* deletion, especially the deletion of *y* before *e*, has not been investigated empirically. On the basis of a large sociolinguistic database this paper will examine the deletion of *y* in Seoul Korean, reveal the constraints conditioning the process, and attempt its phonological account. It will be suggested that Seoul Korean has two different processes of *y* deletion (one categorical process and one variable process) and are triggered by two different OCP constraints.

The results of the analysis of the data also suggest that *y* deletion is not just a synchronic process but also a diachronic process, i.e., sound change in progress, which occurs only before the vowel *e*. A phonetic explanation of this ongoing sound change is also attempted in this paper.

The phonetic account of the ongoing change will be a perception-based explanation along the lines of Ohala (1981, 1993). It will be shown that among the *y* diphthongs of Seoul Korean *ye* has the shortest perceptual distance between the diphthong's component segments when formant frequency and amplitude, the two acoustic parameters most relevant in the perception of diphthongs, are considered. It will be claimed that this is primarily why *ye* alone, among the *y* diphthongs of Seoul Korean, is losing *y*.

The organization of this paper is as follows: in section 2, some background information on *y* deletion in Seoul Korean will be provided. The data and methodology used in this study are discussed in section 3. The results of the data analysis will be given in section 4. The sociolinguistic and linguistic implications of the results will be discussed in section 5. An attempt will be made to provide a phonological and phonetic account of *y* deletion in section 6, which are followed by concluding remarks in section 7.

2. *y* Deletion in Seoul Korean and its Background

In this section I will provide some background information on *y* deletion and then introduce two different processes of *y* deletion that are observed to occur in Seoul Korean.

The syllable structure of Seoul Korean can be schematized as in Figure 1. The minimal syllable is V with three optional elements: onset, glide, and coda. The internal structure of the Seoul Korean syllable is rather controversial; this comes from the uncertain status of two glides of Korean, *w* and *y*. Some phonologists (e.g., Sohn 1987, H.Y. Kim 1990) claim that the

GV sequence is a diphthong (thus G forming a constituent with the following V), while others (e.g., Ahn 1988, Y.S. Lee 1993) argue that CG is a constituent, forming an onset cluster. (See Y.S. Lee 1993 and H.Y. Kim 1990 for a discussion of this debate.) Following the socio-historical tradition the present study takes the position of phonologists like Sohn (1987) and H.Y. Kim (1990) in assuming that GV sequences in Seoul Korean are rising diphthongs.

σ

(C)(G)V(C)

Figure 1. Syllable Structure of Seoul Korean.

This study also assumes that contemporary Seoul Korean has the monophthongs shown in Table 1. It is assumed that *ü* and *ø* have diphthongized to *wi* and *we* (cf. Kim-Renaud 1974 and Park 1992) and therefore are no longer monophthongs of this dialect. The present study also takes the position (following Hong 1988 and H. B. Lee 1971) that *e* and *ε* have merged to *e*.

Table 1. Monophthongs of Seoul Korean

[-bk]	[+bk]	
i	ɨ	u
e	ɔ	o
	a	

Table 2 gives the current inventory of *y* diphthongs of Seoul Korean. It is assumed that *yε* has merged with *ye*, following the merger of *e* and *ε*. As shown in the table, *yi* and *yɨ* are not possible sequences in this dialect.

Table 2. *y* Diphthongs of Seoul Korean

[-bk]	[+bk]	
*yi	*yɨ	yu
ye	yɔ	yo
	ya	

The current system of Seoul Korean consonants is as given in Table 3. The articulation place of Korean affricates is not without controversy. Most researchers (e.g., C.W. Kim 1968, Kim-Renaud 1974, Cho 1988, H.Y. Kim 1990, Hume 1990) take the position that these consonants are palatals or alveo-palatals, both [cor, -ant], which is why the process where /kuti/ changes to [kuci] 'unfailingly' is termed "palatalization" in literature. Whereas phonetic studies such as H.S. Kim (1997) and Skaličková (1960) suggest that Korean affricates are more likely to be alveolars rather than (alveo-) palatals. The current study follows the majority position that holds Korean affricates as (alveo-)palatals.[1]

Table 3. Consonants of Seoul Korean

	bilabial	alveolar	(alveo-) palatal	velar	glottal
stop	p, p', p^h	t, t', t^h		k, k', k^h	
affricate			c, c', c^h		
fricative		s, s'			h
nasal	m	n		ŋ	
liquid		l			

As the syllable structure of this dialect, CGVC, implies, a single consonant can precede and combine with *y* diphthongs, though not all logical possibilities are actually realized. In particular, the combination of a coronal obstruent and *y* is not allowed underlyingly, though for some alveolars the combination is allowed on the surface involving verb morphology through glide formation (i.e., derivationally),[2] e.g., */sy/ but /o + si + əs' + ta/ -->

[1] One noteworthy claim regarding the Korean affricates is found in K. M. Lee (1984, 1985) and K. U. Kang (1993), where it is suggested that the consonants used to be alveolars (or dentals) but changed to (alveo-)palatals in the early 17C except in the Phyengan dialect. Since *i* is a palatal vowel, this claim can crucially explain the diachronic 'palatalization' changes that happened from the middle of 17C, e.g., /tita/ > /cita/ 'fall' and /kot^{h}ita/ > /koc^{h}ita/ 'correct', /t^{h}ita/ > /c^{h}ita/ 'hit' (K.W. Nam 1984: 125).

[2] Seoul Korean has the following *y* glide formation process : i --> y / ______ + ə, *a* (cf. Han 1990, Y. S. Lee 1993). This rule involving verb morphology can be both categorical and optional in the sense that it has to apply to some verbs but does not have to others.

[osyətt'a] [3] 'came (Hon.)'.

With the background introduced so far, I will now discuss the two phonological environments where *y* deletion occurs in Seoul Korean. First, the glide deletes after (alveo-)palatal consonants as (2) illustrates (S.K. Kim 1976, Nam 1975, Sohn 1991, Cho 1988, Han 1990). This is a categorical process and can be formulated as rule (1).[4]

$$\text{(1)}\ y \dashrightarrow \emptyset \,/\, \left\{\begin{matrix} C \\ C^{h} \\ C' \end{matrix}\right\} \underline{\quad\quad} \ V\ \text{(categorical)}$$

(2) "lost"	"skated"	"blossomed"	
/ci+əs'+ta/	/cic^{h}i+əs'+ta/	/p^{h}i+əs'+ta/	UR[5]
cyəs'ta	cic^{h}yəs'ta	p^{h}yəs'ta	Glide Formation (cf. fn. 2)
cəs'ta	cic^{h}əs'ta	--	y-Deletion
[cəs'ta]	[cic^{h}əs'ta]	[p^{h}yəs'ta]	SR[6]

Secondly, as (3) shows, *y* variably deletes before *e* -- but not before any other vowel. In this process, the deletion rate of *y* is crucially influenced by whether there is a preceding consonant (e.g., /yup^{h}ye/ --> [yup^{h}e] 'confinement') or not (e.g., /toye/ --> [toe] 'ceramic art'). When there is a preceding consonant, the deletion of *y* is significantly more frequent than when there is not (90% vs. 25% according to my data: see Tables 7 and 8 in section 4).

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[3] Korean has a coda neutralization rule that neutralizes obstruents to lenis voiceless stops in coda position and an obstruent tensing process where lenis obstruents become fortis when preceded by an obstruent and also in some other rather complex phonological and morphological environments in Korean (see C.S. Lee (1994: 328-31) for details).

[4] One of the reviewers suggested that *y* can delete not only after a (alveo-)palatal but also after other coronal consonants such as /t, s, n/. This might be true in Southern dialects, especially in the *Kyengsang* dialect. However, I believe that the deletion of *y* in the latter environments are not found in the Seoul dialect except in speech errors.

[5] *ci-*, *cic^{h}i-*, and *p^{h}i-*, respectively, means 'lose', 'skate', and 'blossom'. *əs'* is a past tense marker; *-ta* is a declarative ending.

[6] As introduced earlier, Korean has a coda neutralization process neutralizing obstruents to lenis voiceless stops in coda position, and a tensing rule that strengthens a lax obstruent to its tense counterpart after an obstruent. However, since these processes are not directly relevant here, they are ignored.

(3) y --> ø / (C) ____ e (variable)

The process shown in (1), categorical deletion, will not be discussed up until section 6. The main focus from sections 3 to 5 will be the process (3), variable *y* deletion.

3. Methodology

3.1. Data

The data analyzed in this study were collected during the author's fieldwork in Seoul in the summer of 1994 and from the winter to early spring of 1995. Approximately 30 minutes of recordings were made from each speaker. The speakers were stratified by age, social status, and gender. They were divided into 2 gender groups, 3 social status groups, and 3 age groups. Four different styles of speech were elicited -- two styles of spontaneous speech: interview and ingroup speech; and two styles of read speech: sentence and word reading. The data on which this study is based come from the recordings of 63 native speakers of the Seoul dialect.

The speakers' speech was transcribed and the tokens of (y) were identified. The tokens of (y) in all portions of the recordings of conversational speech were used for this study. The sentence and word lists contained 26 and 25 potential tokens of variable (y), respectively (cf. Appendix 1). The potential tokens were designed to reveal the effects of the linguistic constraints on *y* deletion (which will be discussed in the following section).

As shown in Kang (1996a), the distinction between word-intial and non-word-initial syllables is an important constraint on *ɯ*-deletion in Seoul Korean. This constraint is predicted to play a significant role in *y* deletion as well. One noticeable difference between the tokens of (y) in spontaneous speech and those designed tokens (i.e., tokens in read speech) is that while the latter shows a relatively balanced proportion between tokens where *y* occurs in a word-initial syllable (e.g., /yeyən/ 'prophecy') and those where the glide appears in non-word-initial syllables (e.g. /suye/ 'weaving'), the tokens found in spontaneous speech are mostly instances of (y) appearing in a word-initial syllable (see Table 4). This asymmetry is attributable to the fact that in those words commonly used in conversational speech, tokens of (y) appear in a word-initial syllable much more often than in noninitial syllables. As a result, a simple comparison of raw percentages of *y* deletion can be very misleading in the interpretation of the results of this study because there is a significant difference between word-initial and noninitial syllables in the frequency of y deletion (as will be shown later).

Table 4. The Distribution of Tokens of (y) — Style vs. Syllable Position

	Initial	Noninitial
ingroup	257 (87%)	38 (13%)
interview	379 (75%)	123 (25%)
sentence list	464 (38%)	768 (62%)
word list	522 (44%)	661 (56%)

The judgment regarding the presence and absence of the glide was made at the time of transcriptions and rechecked before the statistical analysis. Each token was judged {y}, {ø}, and 'ambiguous'. Ambiguous cases accounted for approximately 6 percent (207/3419) of the tokens. They were excluded from further analysis. Misread and unread potential tokens were also excluded.

Instances of (y) which occur before e and after (alveo-)palatal consonants were 7 in interview speech and 22 in ingroup speech. The sentence-list and word-list contained no such tokens. As expected, y deleted categorically in all 29 cases, so these tokens were not included in the variable rule analysis either (because they are not variable cases). One hundred tokens were chosen from each of the {y}, {ø}, and 'ambiguous' token groups. Another Seoul Korean speaker independently checked these tokens and labeled each as {y}, {ø}, and 'ambiguous'. There was 85, 87, and 72 percent agreement between her judgments and mine in {y}, {ø}, and 'ambiguous' token groups, respectively. The two judges' agreement on the presence/absence of y was lower (81/82 percent) in the tokens where the glide follows/does not follow obstruents. The two judges' agreement percentages were higher with the other types of tokens. The study of the variable deletion of y is based on 3212 tokens of variable (y) from 63 speakers' data containing both conversational and read speech.

3.2. Variable Rule Analysis

3.2.1. A Preliminary Analysis

Variable rule analysis (cf. Sankoff 1988, Sankoff and Labov 1979) was designed, and has been used for the analysis of sociolinguistic variables, i.e., the analysis of speakers' choice among two or more variants with same meaning. One clear advantage of variable rule analysis over univariate analysis (e.g., the chi-square test) is that it can "separate, quantify, and test the significance of the effects of environmental [conditioning] factors on a linguistic variable" (Guy 1993: 8). Another advantageous feature has been built into recent versions of variable rule analysis. It is the automatic selection (performed by the statistical procedure called 'stepwise regression analysis') of those constraints (or factor groups) that have statistically significant effects on speakers' choice among the variants of a given variable. In consideration of these advantages variable rule analysis was adopted as a statistical tool for the present study and a preliminary statistical analysis of the tokens was performed using Goldvarb (version 2.1 Rand and Sankoff 1992), a variable rule analysis program for MacIntosh. Factor groups, i.e., possible constraints on sociolinguistic variation, listed in Table 5 were considered in this analysis.

First, the presence/absence of the preceding consonant was considered because, as noted earlier, *y* deletion is sensitive to whether there is a preceding consonant or not. The consonants that can occur before the sequence *ye* are p^h, *k, k', h, l, ɾ, n,* and *ŋ*.[7] To examine whether these consonants show different effects on the deletion of *y*, each consonant was coded as a separate factor and the factor group, 'preceding consonant', was also considered in the analysis. One thing to note here is that the consonants *l, ɾ, n,* and *ŋ* can occur before *ye* only in non-word-initial syllables, i.e., there are no word-initial sequences *lye, ɾye, nye,* and *ŋye* in Seoul Korean (as opposed to [sillye] 'impoliteness', [coɾye] 'regulations', [yoŋnye] 'usage', [kuŋye] 'kungye' (founder of the kingdom *hwukokwulye*).

[7] The consonants *l, ɾ,* and *n* are all from underlying /l/. Korean has a phonological process where /l/ becomes [ɾ] in intervocalic environments, e.g., /alyəŋ/ --> [aɾyəŋ] 'dumbell'. /l/ is also nasalized to [n] after the sequence 'consonant + morpheme boundary', e.g., /yoŋ+lye/ --> [yoŋ + nye] 'usage' (cf. Kim-Renaud 1986: 41).

Table 5. Factor Groups Considered in the Preliminary Variable Rule Analysis of *y* Deletion

Factor groups:	Factors:
1. presence of a preceding C	ø, present
2. preceding consonant	*p^h, k, k', h, l, ɾ, n, ŋ*
3. syllable position	word-initial, non-word-initial
4. speech style	ingroup, interview, sentence reading, word reading
5. gender	male, female
6. social status	upper, middle, lower
7. age	16-25, 26-45, 46 or older

As mentioned in the previous section, the distinction between word-initial vs. non-word-initial syllables is an important constraint on *ɯ* deletion (and also some other synchronic and diachronic variation) in Seoul Korean (cf. Kang 1996a, Kim-Renaud 1986). Accordingly, the factor group, 'syllable position', was also considered as a possible constraint on *y* deletion. External constraints, 'speech style', 'gender', 'social status' and 'age', were included as well in the analysis to see whether variable *y* deletion is also sensitive to these social and stylistic factors.

The results of the preliminary variable rule analysis were, unfortunately, very problematic (Table 6). The constructed statistical model showed a very bad fit to the data (x^2/cell = 3.1696). In Varbrul (or variable rule) analysis, if a chi-square/cell value is bigger than 1.5, the results of the analysis are not generally considered as very reliable. Since 3.1696, the chi-square/cell value of the preliminary analysis, is much bigger than 1.5, the results of this analysis, naturally, cannot be taken as trustable.

It is presumed that this result is due to the fact that the constraints considered show rather different effects on post-consonantal *y* deletion, on the one hand, and on non-post-consonantal *y* deletion, on the other. Most notably these two were subject to rather different effects by the factors of 'syllable position'. (Refer to Tables 7 and 8 in section 4: while the initial and noninitial syllable factors, respectively, show Varbrul weights .295 and .657 in post-consonantal *y* deletion,[8] the two show weights .168 and .970 in

[8] If a factor has a Varbrul weight bigger than .5, it is said to "favor" the application (deletion here); if the weight is smaller than .5, the factor "disfavors" the

non-post-consonantal deletion.) The most radical discrepancies between expected frequencies and observed frequencies of deletion were found in cells where *y* (i.e., the presence of *y*) is preceded by a consonant and appears in a non-word-initial syllable.[9] Among the 15 cells where the difference between the two values was bigger than '10', 14 were such cells. The fact that the factor group, 'presence of a preceding C', was not selected in the stepwise regression analysis -- despite a clear difference in Goldvarb weight between its two factors (.668 vs .164) -- also reveals the unreliability of the results from the preliminary analysis. Accordingly separate Varbrul analyses of the two types of tokens of (y) -- those for post-consonantal *y* and those for non-post-consonantal *y* -- were performed.

Separate Varbrul analyses considered the following factor groups. The analysis of post-consonantal *y* deletion included two linguistic constraints, 'preceding consonant' and 'syllable position', and four possible external constraints, 'speech style', 'gender', 'social status', and 'age' in the statistical model. Factor group 'presence/absence of a preceding C' considered in the preliminary analysis, was naturally excluded. The Goldvarb analysis of non-post-consonantal *y* deletion considered one linguistic factor group, 'syllable position', and four external factor groups, 'speech style', 'gender', 'social status', and 'age'. Those two factor groups considered in the preliminary analysis, 'presence of a preceding C' and 'preceding C', were not included in the statistical model because they are not relevant in this analysis.

Table 6. Goldvarb Probabilities for Factors for *y* Deletion (Preliminary Run)

Factor Groups	Factors	Weight	%Applications	Total N
Presence of C	present	.668	90	2242
	ø	.164	25	970

application; .5 is neutral.

[9] While the probabilities for the factor 'initial' are rather similar (.168 vs .295: .127 difference) between the two types of deletion (post-consonantal and non-post-consonantal *y* deletion), those for 'noninitial' are quite different (.657 vs .970: .313 difference). As a result, the combination of the data for non-post-consonantal *y* deletion and the data for post-consonantal *y* deletion produces a much higher expected value of *y* deletion for those cells where *y* (the presence of *y*) occurs post-consonantally in a noninitial syllable.

Factor Groups	Factors	Weight	%Applications	Total N
*Preceding C	p^h	.591	90	527
	k	.795	96	805
	k'	.294	97	75
	h	.832	95	351
	l	.018	70	70
	ɾ	.036	81	182
	n	.019	70	154
	ŋ	.024	73	78
*Syllable Position	initial	.139	55	1622
	noninitial	.865	85	1590
*Speech Style	ingroup	.586	50	295
	interview	.560	56	502
	sentence R	.536	74	1232
	word list R	.416	77	1183
Gender	male	.512	71	1646
	female	.487	69	1566
*Social Status	upper	.424	69	1101
	middle	.525	71	1087
	lower	.556	70	1024
*Age	16-25	.615	76	1131
	26-45	.598	73	988
	46+	.301	61	1093

number of cells: 603 total x^2 = 1911.2879 x^2/cell = 3.1696
loglikelihood = -889.633 Input = .917 Overall deletion rate = 70%

(NB: a. Starred factor groups are those chosen as significant in the stepwise regression analysis.
b. % applications indicate percentage of deletion.)

4. Results of Variable Rule Analysis

Both of the separate Goldvarb analyses showed an acceptable fit of the statistical model to the data. (chi-square/cell was smaller than 1.5 in both cases.) The results of the Goldvarb analysis of post-consonantal *y* deletion are given in Table 7.

Five of the six factor groups were selected as significant in the stepwise regression analysis. In the order of selection, the chosen constraints are 'preceding consonant', 'age', 'syllable position', 'speech style', and 'social status'. (Generally the order of selection in the stepwise regression analysis reflects the order of constraints in strength.) The factor group, 'gender', was not chosen as significant, suggesting that male and female speakers showed little difference in their behavior toward *y* deletion. The deletion rates of *y* in initial vs. noninitial syllables (i.e., 91% vs. 89%) are misleading, because sonorant consonants, which trigger the deletion of *y* significantly less often than obstruents (75% vs. 94%: cf. Table 7: 1st factor group), can occur before *ye* only in noninitial syllables.

Table 7. Goldvarb Probabilities for Factors for Post-consonantal *y* Deletion (2nd Run)

Factor Groups	Factors	Weight	%Applications	Total N
*Preceding C	p^h	.504	90	527
	k	.689	96	805
	k′	.626	97	75
	h	.747	95	351
	sonorant C	.099	75	484
*Syllable Position	initial	.295	91	958
	noninitial	.657	89	1284
*Speech Style	ingroup	.641	96	141
	interview	.611	95	280
	sentence R	.538	91	898
	word R	.408	86	923
Gender	male	.502	90	1165
	female	.498	89	1077
*Social Status	upper	.421	87	788
	middle	.532	91	764
	lower	.556	91	690
*Age	16~25	.628	94	801
	26~45	.601	94	687
	46+	.282	82	754

number of cells: 375 total x^2 = 470.7270 x^2/cell = 1.2553
loglikelihood = -590.548 Input = .945 Overall deletion rate = 90%

Sonorant consonants (i.e., *l, ɾ, n, ŋ*) showed relatively uniform effects on *y* deletion, i.e., the weight of each sonorant consonant was as follows: *l* (.076), *ɾ* (.141), *n* (.076), *ŋ* (.096) (see Appendix 2). The loglikelihood significance test (see Guy 1993 for its details) did not find a significant difference ($p > .05$) between the Goldvarb run where each of the sonorant consonants was analyzed as a separate factor (cf. Appendix 2) and the run where the sonorant consonants were collapsed together. Table 7 is the results of the latter Varbrul run where the statistical model has been simplified. (A more simplified and thus more general statistical model is preferred in variable rule analysis (cf. Guy 1993)). However, it was not possible to collapse the obstruent consonants as one factor, because the same test found that the Goldvarb run where they were collapsed together showed a significantly worse fit of the model to the data in terms of loglikelihood.

The results of the Goldvarb run of non-post-consonantal *y* deletion are as given in Table 8. Four of the five factor groups, 'syllable position', 'age', 'speech style' and 'social status' were selected in the stepwise analysis and in that order. A big discrepancy between deletion percentages and Goldvarb weights in 'speech style' (2nd factor group) comes from an asymmetry between spontaneous and read speech in the distribution of tokens (cf. Table 4): in spontaneous speech tokens of (y) appear mostly in word-initial syllables where *y* deletion occurs only rarely (see the 1st factor group of Table 8). Again the factor group, 'gender', was not chosen in this analysis as a significant constraint on *y* deletion. As noted earlier, the results show that the main difference between post-consonantal and non-post-consonantal *y* deletion is the strength of the factor group, 'syllable position'. The effect of this constraint is noticeably stronger in non-post-consonantal deletion.

Table 8. Goldvarb Probabilities for Factors for Non-post-consonantal *y* Deletion

Factor Groups	Factors	Weight	% Applications	Total N
*Syllable Position	initial	.168	04	664
	noninitial	.970	70	306

Factor Groups	Factors	Weight	% Applications	Total N
*Speech Style	ingroup	.696	08	154
	interview	.652	07	222
	sentence R	.436	39	334
	word R	.333	30	260
Gender	male	.539	25	481
	female	.462	24	489
*Social Status	upper	.408	24	313
	middle	.519	24	323
	lower	.568	25	334
*Age	16-25	.599	30	330
	26-45	.594	28	301
	46+	.325	17	339

number of cells: 114 total x^2 = 141.3995 x^2/cell = 1.2403
loglikelihood = -270.202 Input = .103 Overall deletion rate ≈ 25%

5. Discussion

The results of the Goldvarb analyses shown in Tables 7 and 8 suggest that three linguistic constraints condition variable *y* deletion in Seoul Korean. The first is the presence of a consonant preceding *y*. The deletion of *y* occurs approximately 90 percent after a consonant and 25 percent without a preceding consonant. This result indicates that the presence of a consonant is a crucial constraint on *y* deletion.

The results also show that consonant type is another important factor in *y* deletion. As mentioned earlier, in Varbrul terms, when the weight of a given factor is above .5 (or under .5), that factor is said to favor (or disfavor) the application of the rule (deletion in the present study). Table 7 shows that in terms of Goldvarb probabilities obstruents (p^h, *k*, *k'* and *h*) favor *y* deletion, while sonorant consonants strongly disfavor the process. The table also shows that *y* deletes after obstruents approximately 94% on an average and 75% after sonorant consonants. This result implies that the diphthong *ye* is almost monophthongized after obstruents but not quite after sonorant consonants. Choi (1983), a phonological study, suggests that in the *Cenpwuk* dialect *y* diphthongs (not just the *ye* sequence) have monophthongized after obstruents but not after sonorant consonants, i.e., he suggests that *ye, yə, ya, yu,* and *yo* have monophthongized to *e, e, ε, ü,* and *ö,* respectively only after obstruents.[10] A similar pattern of change is exhibited in the Seoul dialect but only in *ye.*

The third linguistic constraint that is shown by the Goldvarb results to play an important role in variable *y* deletion is whether the glide occurs in a word-initial or non-word-initial syllable. This constraint has significant effects on both post-consonantal and non-post-consonantal deletion (see Tables 7 and 8). Yet its effect is considerably stronger in non-post-consonantal deletion. The results of the data analysis show that *y* deletion rarely occurs in an initial syllable when there is no preceding consonant, i.e., when *y* is a word-initial segment. Only 4% of deletion occurs here as opposed to 70% of deletion in noninitial syllables (cf. Table 8). These results support Kim-Renaud's (1986) claim that a word-initial syllable, especially the initial segment of a phonological word, has a phonologically strong nature in Korean; the results can also be taken to support Foley (1977) and Hyman's (1975) claim that cross-linguistically word-initial position is a phonologically strong position while word-final position is a weak (weakening) position, when it is considered that a significant portion of Korean lexical items are two-syllable words thus often making a non-word-initial syllable identical with a word-final syllable.

The fact that *y* deletion is a sociolinguistic process is evidenced by the result that factor groups 'social status' and 'age' are found to be significant constraints in the stepwise regression analyses. The results show that the upper status speakers 'disfavor' *y* deletion, while the other social status groups 'favor' the process (see Tables 7 and 8). A more clear difference in *y* deletion in terms of Varbrul weight is shown among the age groups. The results show that the oldest group disfavors *y* deletion as opposed to the two younger groups who favor it. This result suggests (coupled with external evidence discussed below) that *y* deletion is not just a synchronic process but also a linguistic change in progress. The results of this work seem to indicate that *ye* has almost monophthongized after obstruents, while the *ye* to *e* change after sonorant consonants is still under way. (Recall that *y* deletes 94% and 75% after obstruents and sonorant consonants, respectively.) In fact, Nam (1984: 23) makes a similar claim: he suggests

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[10] Choi (1983) assumes that the *Cenpwuk* dialect has a 10-vowel monophthongal system: *i, ü, ɨ , u, e, ö, ə, o, ɛ, a.*

that in Seoul Korean *ye* has virtually monophthongized to *e* in all post-consonantal contexts except after /l/, which can be realized as [l], [ɾ] and [n] as discussed earlier.

The claim that *ye* is monophthongizing to *e* obtains external support from prescriptive literature, if we accept the common wisdom that prescriptive grammar reluctantly follows actual production by the members of a speech community only when that production is overwhelmingly predominant. The production of *ye* as *e,* i.e., the deletion of *y* before *e,* has not been allowed by prescriptive grammar until recently. However, the latest publication on standard pronunciation by the Ministry of Education (1988), *phyocwun palumpep* ("Standard Pronunciation of Korean"), contains an article stating that "the diphthong *ye* can be pronounced as *e* after a consonant unless /l/ precedes it".[11] This statement is a prescription that *ye* should be pronounced as *ye* after /l/, i.e., [l], [ɾ], and [n], while allowing monophthongal production when obstruents precede the diphthong. This (prescriptive) statement implicitly reveals that Seoul Korean speakers' deletion of *y* before *e* after sonorant consonants is still not as prevalent as *y* deletion after obstruents.

Another piece of evidence supporting the monophthongization change of *ye* is found in the spelling changes of some words containing an "obstruent + *ye*" sequence. The spelling of such words as *khyekhyehata* 'be stuffy', *hyealita* 'count', and *pyeta* 'lay one's head (on the pillow)' officially changed to *khekhehata, healita,* and *peta* through the 1988 spelling reform, *hankul macchuwumpep kaycengan* ("Revision Proposal for the Korean Spelling System"). These spelling changes are considered as a clear reflection of the diachronic loss of /y/ before *e* after obstruents.

The finding that *y* deletes even without a preceding consonant (nearly exclusively in non-word-initial syllables) seems to show that the diachronic loss of *y* before *e* is extending to other phonological environments. (A similar change is found in Japanese, which completely lost *ye* during the 18th to 19th century (Vance 1987).) The fact that the loss of *y* is happening

[11] The publication uses orthographic rather than phonetic symbols following the custom of traditional Korean grammar and linguistics. The statement is actually as follows: "The production of 예 (/ye/) as 에 (/e/) is allowed except in 예 (/ye/) and 례 (/lye/)". The reason that /ŋ/ is disregarded in this statement is attributable to the fact that /ŋ/ always occurs in the previous orthographic letter, not in the same letter with /ye/ (e.g., 궁예: /kuŋ-ye/). Nam's (1984) statement mentioned above follows the same practice, and that is probably why he failed to mention /ŋ/.

only in *ye* but not in the other *y* diphthongs points to the possibility that there may be inherent instability in this diphthong that the other *y* diphthongs of Seoul Korean do not share. In the following section an attempt will be made to provide a phonological account of this instability in *ye*. A phonological account of categorical *y* deletion, which was discussed in section 2, will also be attempted. Two OCP constraints with different strengths are proposed as being responsible for two different processes of *y* deletion in Seoul Korean.

6. Towards Explanations

6.1. Phonological Account of *y* Deletion

One of the interesting facts with *y* deletion in Seoul Korean is, as noted above, that two rather different processes cooccur. To repeat, one is a categorical process formulated as in (1) where *y* deletes after (alveo-)palatal consonants; the other is a variable process which occurs only before *e*. Considering that Korean does not have *yi*, the defining feature that distinguishes *e* (and *i*) from the other vowels of Seoul Korean which can combine with *y* is [back] -- *e* (and *i*) is [-back], while the others are [+back] (cf. Table 1). If we adopt the feature system of Clements and Hume (1995), i.e., unified features theory, the phonological feature that distinguishes *e* (and *i*) from the others is [coronal]. The Seoul Korean data examined in this study show that both categorical and variable deletion of *y*, a coronal vocoid in Clements and Hume's (1995) feature model, is triggered by an adjacent coronal segment, i.e., by an OCP effect. I propose that the two types of *y* deletion in Seoul Korean are mainly attributable to the first two OCP constraints shown in Figure 2, while *yi* is prohibited by the rightmost constraint.

OCP(CG: cor) is a constraint which prohibits the sequence '(alveo-)palatal consonant + *y*' in Korean, while OCP(GV1: cor) prohibits the sequence '*y* + *e*'. As mentioned above the sequence *yi* is not allowed in this language, which indicates that Korean additionally has the constraint OCP(GV2: cor) as shown in Figure (2c). I consider these three as part of the phonological constraints operating in Seoul Korean on the "surface" level. The motivation from which OCP(GV: cor) is exploded into two comes from asymmetrical strengths of OCP(GV1) and OCP(GV2). The latter is more powerful than the former in that the latter totally disallows *yi*, while *ye* is possible in

Seoul Korean.

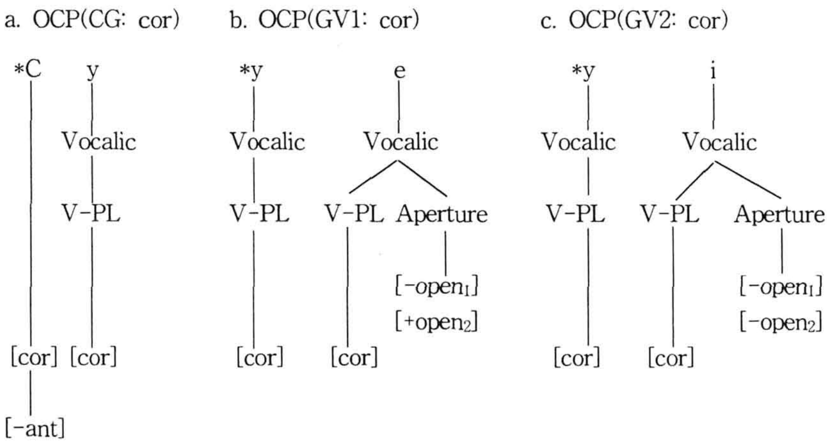

Figure 2. Three Proposed OCP Constraints Against Adjacent Coronal Segments *in Seoul Korean*

(NB: a. Similar yet not identical constraints to the first and third constraints are proposed in previous works such as Kim (1994) and Sohn (1991).
b. The constraints are formulated based on features proposed in Clements and Hume (1995).)

As suggested earlier, Korean has morpheme structure constraints that prohibit the following underlying sequences: */ty/, */t^hy/, */t'y/, */sy/, */s'y/, */cy/, */c^hy/, and */c'y/. In other words, Seoul Korean has no morphemes with underlying sequences of 'obstruent coronal C + *y*'. Accordingly, previous studies such as H.S. Kim (1994) and Clements (1991) proposed OCP-based cooccurrence restrictions against the above underlying sequences. Following the OT concept, the currently dominant phonological model, this work proposes an OCP constraint on surface forms. Some sequences of 'alveolar C + *y*' are allowed as surface forms in Korean as mentioned earlier; they can arise involving verb morphology through the process of glide formation. For instance, [hasyə] is a phonetic form that surfaces from underlying /ha + si + ə/ (*do* + Hon. + Conn.), except in the most careful speech where [has^{y}iə] can be produced by speakers. To give another example, [tidyətt'a][12] can surface from underlying /titi + əs' + ta/

'stepped on + Pst. + Decl.'. However, the sequence '(alveo-)palatal C + *y*' is prohibited in Seoul Korean on the surface. I propose that the sequence '(alveo-)palatal C + *y*' is not allowed in Korean because of the presence of the constraint given in Figure (2a).

I suggest by proposing the first two OCP constraints in Figure 2 that both categorical and variable processes of *y* deletion are OCP-triggered (Yip 1988), i.e., that *y* deletes in Seoul Korean in order to satisfy the above two OCP constraints against successive coronal segments. However, the strengths of OCP(CG: cor) and OCP(GV1: cor) do not seem to be identical. I would suggest that this is why one triggers categorical deletion and the other, variable deletion.[13]

I have suggested above that the reason why *y* deletes often before *e* is that there is an OCP constraint in Seoul Korean prohibiting this sequence. I also suggested that the deletion of *y* before *e* is a linguistic change in progress. Yip (1988: 86) claims that the OCP can function not only as a synchronic rule trigger but also as a trigger of a diachronic process. I would suggest that *y* deletion before *e* in Seoul Korean is one example where both synchronic and diachronic processes are observed to be triggered by the OCP simultaneously.

A number of researchers including Pierrehumbert (1993) and Zubritskaya and Sheffer (1995) have suggested that often the OCP, a phonological configurational constraint, has a phonetic (i.e., perceptual or articulatory) basis. In the following subsection I will show that the OCP constraint that triggers the diachronic process of *y* deletion has a perceptual basis and supports the above researchers' suggestion. An attempt will be made to show why only *ye*, among *y* diphthongs of Seoul Korean, shows instability. It will be argued that instability in *ye* comes from perceptual factors, and that the monophthongization of *ye* to *e*, a presumed OCP-triggered diachronic change, is a perceptually motivated process.

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[12] There is a weakening process in Korean where lenis voiceless stops become voiced between voiced segments.

[13] The difference in the strengths of these two constraints is shown in Kang (1996b) within the framework of Optimality Theory (OT) extended by the notion of 'variable dominance' (cf. Reynolds 1994). Kang (1996b) suggests that variability involving *y* originates from a variable dominance relationship between OCP(GV1: cor) and MAX(i), where both the relationships "OCP(GV1: cor) > MAX(i)" and "MAX(i) > OCP(GV1: cor)" hold. The study also shows that OCP(CG: cor) is an undominated constraint in Seoul Korean phonology, while OCP(GV1: cor) is dominated by other constraints.

6.2. Phonetic, Perceptual Account of Instability in *ye*

Phonetically diphthongs are defined as vowel-like sequences that cannot be characterized by a single vocal tract shape or by a single formant pattern (Kent and Read 1992, Laver 1994). A diphthongal sequence is normally considered as consisting of two components: 'glide + vowel' or 'vowel + glide'. Phoneticians also use the terms 'onglide' or 'onset' to refer to the first part of the diphthong and 'offglide' or 'offset' to refer to the second part (Peters 1991). The term 'nucleus' is also used to refer to the more sonorous portion of the diphthong (Kent and Read 1992).

What is noteworthy is that languages prefer a certain type of diphthongal sequence over others. According to Lindau, Norlin, and Svantesson (1990), *diphthongs occur in about one third of the world's languages. Diphthongs of* the *ay*-type occur in 75 percent of these languages and the *aɯ*-type occurs in about 65 percent. Lindau et al. (1990) report that these two types of diphthongs are the most frequently found among the languages which they surveyed. On the other hand, Eström (1971), who examined 83 languages that have diphthongs, reports that languages prefer those whose nucleus has greater sonority (or amplitude) -- i.e., languages prefer low vowels to mid vowels, and mid vowels to high vowels as a nucleus of the diphthong. Eström's findings are summarized in Table 9.

Table 9. Percentage of Languages for Which the Indicated Vowel is the Nucleus of a 'nucleus + glide' Sequence (N = 83)

a/ɑ	o/ɔ	e/ɛ	u	i
83%	34%	25%	18%	7%

(Source: Eström 1971 (quoted in Lindblom 1986: 37))

Kawasaki (1982) also makes a similar suggestion on the basis of her survey of diphthongs of various languages. She (ibid.: 28) notes that "combinations of a low vowel and a high vowel are favored over other combinations of vowels", which is basically the same finding as that of Lindau et al. (1990). Another important point that her survey reveals is that rising diphthongs also prefer the combination of 'low vocoid + high vocoid', though the sequence in their cases is not 'low vowel + high glide' but 'high glide + low vowel' (see Kawasaki ibid.: 28). What these three reports, which are very comparable to one another, suggest is that languages prefer those diphthongs whose onset and offset are maximally (or sufficiently) different in the acoustic-auditory domain. These surveys also support rather impressionistic observations made by scholars (e.g., Stockwell 1978, Stampe 1972, Rosenthall 1994) that languages prefer diphthongs which have maximal differentiation in formant frequency and/or sonority (amplitude) between the glide and the nucleus.[14]

Diphthongs of Seoul Korean do not seem to be an exception to this cross-linguistic tendency. As shown in Table 2, the sequence *yi*, whose onset and offset are least perceptually distinct, is not attested in Seoul Korean. Ohala (1980, 1992) suggests that maximum (or sufficient) perceptual distance is important to languages' selection of not only diphthongal sequences but sound sequences in general. He (1992: 325) suggests that the following four acoustic parameters are the most relevant to the perception of sound sequences: spectral shape, amplitude, periodicity, and fundamental frequency. Among these, spectral shape (which, for vowels, can be largely understood in terms of formant frequency) and amplitude are considered as relevant parameters in the perception of diphthongal sequences, because onset and offset of diphthongs, both vocoids, are not well distinguished in periodicity (i.e., voicing) and fundamental frequency (F0). The importance of formant frequency and amplitude in the languages' choice of their diphthongal systems are clearly supported by the three surveys of diphthongs discussed earlier. I will show below that onset and offset of *ye* are the least perceptually contrastive of all '*y* + vowel' sequences of Seoul Korean.

Among the two acoustic parameters relevant to the perception of diphthongs (i.e., formant frequency and amplitude), let us first consider formant frequency. Since there is a general agreement among researchers (e.g., Fox 1983) that F1 and F2 are the most important formants in the perception of diphthongs as well as of monophthongs, these two will be examined here. The current study relies on Yang (1993), a recent acoustic study of Seoul Korean vowels, for the F1 and F2 frequency values. Table 10 shows the

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[14] Stockwell (1978: 343) suggests that diphthongs tend to maximize the perceptual distance from onset to offset in the vowel space; Stampe (1972: 582) observes that diphthongs are developed in such a way as to polarize the difference in sonority and color (i.e., palatality and labiality) between glide and nucleus; Rosenthall (1994: 19) suggests that languages prefer those diphthongs whose glide and nucleus have a maximal sonority distance.

average F1 and F2 values of the monophthongs of Seoul Korean produced by ten male speakers as reported in Yang (1993).

Table 10. Average F1 and F2 Values of Seoul Korean Monophthongs Produced by 10 Male Speakers (Source: Yang 1993: 237)

Vowel	F1 (Hz)	F2 (Hz)
i	341	2219
e	490	1968
ɨ	405	1488
a	738	1372
ə	608	1121
u	369	981
o	453	945

Since a perceptual rather than acoustic scale is relevant to the current discussion, the Hz values of F1 and F2 given in Table 10 have been converted to the Mel values using the following formula:

(4) $P = (1000/\log_{10} 2)\ (\log_{10}\ (1 + f/1000))$ (Source: Fant 1973: 48)

Then the calculation of the standard Euclidean distance on the 'formant frequency' plane, i.e., F1 * F2 plane, between the two vocoids of the *y* diphthongs was performed using the formula (5), where the 'glide' distance from onset (i) to offset or nucleus (n), Din, is defined as the Euclidean distance between the two coordinate points, ($M1_i$, $M2_i$) and ($M1_n$, $M2_n$), on the F1 * F2 plane. (M1 and M2, respectively, refer to F1 and F2 values that have been converted to Mel values.) Since the formant values of *y* are presumed to be very similar to those of *i*, the latter's values were used for the glide (the shape of the vocal tract when *y* is produced is highly similar to that for the production of *i* (Kent and Read 1992: 136)).

(5) $Din = \sqrt{(M1i-M1n)^2 + (M2i-M2n)^2}$

NB: Din: glide distance from onset to offset of a diphthong; M1 and M2: F1 and F2 values in Mel.

The results are given in the last column of Table 11. Though onset and offset of diphthongs do not necessarily correspond exactly to monophthongs produced independently (Ladefoged 1982, Yang 1996),[15] Table 11 shows that *e* is perceptually closer to *i* on the F1 * F2 plane than any other vowel of Seoul Korean in terms of spectral shape as reflected in formant frequency. The results from the analysis of formant frequency distance conducted so far predicts that *ye* will be a perceptually indistinct diphthong, which would be more likely to undergo monophthongization than would more salient diphthongs.

Table 11. Perceptual Distance of each Vowel of Seoul Korean from *i* in Terms of 'formant frequency' (Calculated Based on the F1 and F2 Hz Values Given in Table 10)

Vowel	F1 (Mel)	F1-difference from *i*	F2 (Mel)	F2-difference from *i*	Euclidian distance from *i* in terms of formant frequency (Mel)
i	423	0	1687	0	0
e	575	152	1570	117	192
ɨ	491	68	1315	372	378
a	798	375	1246	441	579
ə	685	262	1085	602	657
u	453	30	986	701	702
o	539	116	960	727	736

Now let us go on to examine the difference between onset and offset of the *y* diphthongs in another acoustic parameter, 'amplitude'. There seems to be a general agreement among researchers that amplitude or intensity of vowels is highly correlated with the frequency value of F1 (e.g., Lindblom (1979: 161) suggests that "vowel intensity is governed mainly by the frequency of the first formant."), which also has significant correlations with vowel height and mouth opening (Ladefoged 1982: 178, Kent and Read 1992: 92). This means that amplitude of vowels can be roughly approximated by the frequency value of F1, and that the difference in amplitude between

[15] The best way to obtain the perceptual distance between onglide and offglide of diphthongs will be to calculate the distance between two components of diphthongs based on speakers' actual production of each diphthong. However, since a reliable source for the formant values of two components of Seoul Korean diphthongs is not available, the current study uses the formant values of each vowel produced independently.

onset and offset of diphthongs can be approximated by the difference in the F1 values of the two. Based on this rationale, the current study makes use of the absolute difference in (Mel transformed) F1 values between onset and offset for the approximation of the amplitude distance between the two.

The F1 values of Seoul Korean monophthongs and their respective differences from the F1 value of *i* are given in the second and third columns of Table 12, respectively. The Hz values have been converted to the Mel values using the formula (4) because again a perceptual rather than acoustic scale is relevant here. The table below suggests that *u* and *ɨ*, both high vowels, have probably the shortest amplitude distances from *i*, while the low vowel *a* has the largest amplitude distance. The results shown in Table 12 make us predict that considering vowel intensity alone, *ye* would be more perceptually salient than *yɨ*, *yu*, and *yo* but less salient than *yə* or *ya*.

Table 12. Difference in F1 Values (Mel) between *i* and each Vowel of Seoul Korean as an Approximation of the Perceptual Amplitude Distance from *i*

Vowel	F1 (Mel)	F1-difference from *i* (Mel)
i	423	0
e	575	152
ɨ	491	68
a	798	375
ə	685	262
u	453	30
o	539	116

Following Ohala's suggestion that sound sequences are governed by the simultaneous effects of several factors (of which we are considering spectral shape and amplitude), we can combine the formant frequency and amplitude measures just discussed (given in Tables 11 and 12) into a 'composite' perceptual distance measure. The 'composite' perceptual distance can be obtained by taking both amplitude distance, approximated by the difference in F1 values, and glide distance on the F1 $*$ F2 plane into account. The consideration of both these two parameters are essential in the approximation of 'actual' perceptual distance, because these two both play an important role in the choice of diphthongs by languages. In other words, one of these two parameters alone cannot make a correct prediction of languages' preference or dispreference of certain types of diphthongs, if we assume that languages prefer (or disprefer) diphthongal sequences with maximal (or minimal) differentiation between onglide and offglide. Table 11 suggests that three diphthongs, i.e., *yu*, *yo*, and *yə*, have larger (formant frequnecy) glide distances on the F1 * F2 plane than *ya*, which is suggested as the type of rising diphthongs most favored by languages. Also Table 12 suggests that the diphthong with the least amplitude distance between glide and nucleus is *yu*. However, *yu* is a sequence allowed in Korean and does not show any sign of instability unlike *ye*. These facts combine to show that neither (formant frequency) glide distance nor amplitude distance alone cannot adequately explain why certain types of diphthongal sequences are preferred or dispreferred by languages.

It is a very difficult question how to weight formant frequency and amplitude, the two acoustic parameters relevant in the perception of diphthongs. There is no known or established answer to this question. One possible and plausible way of calculating the composite perceptual distance is to obtain the average of the following two values giving an equal weight to the two -- glide distance between onset and offset and amplitude distance between (on)glide and nucleus approximated by the difference in F1 values. This method assumes that differences in formant frequency and amplitude (between onset and offset) play comparable roles in the perception of diphthongs.[16] The rightmost column of Table 13 lists the approximated perceptual distance of each of the '*y* + vowel' sequences calculated in this method. The table shows that onset and offset of *ye* are the least perceptually distinguishable among the '*y* + vowel' sequences allowed in Seoul Korean.

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[16] The findings by the three surveys mentioned earlier seem to suggest that amplitude plays at least as important a role as formant frequency because languages' preference of *ay* and *aw* type diphthongs and of low vowels as a nucleus of diphthongs may be explained more by the amplitude parameter than formant frequency (refer to Tables 11 and 12).

Table 13. *Composite Perceptual Distance of each of the 'y + vowel' Sequences Obtained by Averaging the Values of Glide Distance on the F1 * F2 Plane and Amplitude Distance as Approximated by the Differences In F1 Values*

Diphthongal sequences	Perceptual distance in terms of formant frequency (Mel)	F1-difference (Mel)	Average difference (Mel)
*yi	0	0	0
*yɨ	378	68	223
ye	192	152	172
ya	579	375	477
yə	657	262	460
yu	702	30	366
yo	736	116	426

NB: The starred sequences are not allowed in Seoul Korean.

Another way of calculating the composite perceptual distance is to weight the F1 difference significantly heavier than the F2 difference and then approximate the perceptual difference between onset and offset. Lindblom (1979, 1986) observes that languages exploit differences in F1 significantly more than differences in higher formants in the distinction of their vowels. He (1986: 22) notes "if vowel systems had developed security margins guaranteeing a certain amount of perceptual differentiation in communication under noisy conditions, they would be expected to exploit F1 (height or sonority) more than other formants …".

He (1979) also shows that the frequency of confusions in the identification of vowel pairs in Swedish and English reported in Nooteboom (1968) and Peterson & Barney (1952), respectively, can be chiefly determined by the first formant differences between vowel pairs -- i.e., the smaller difference in F1 values there is between a vowel pair, the more often the pair was confused with each other. On the basis of this rationale, he proposes to weight F1 significantly heavier than higher formants in the prediction of possible vowel systems of the world's languages, while not attempting to provide a definite answer to the question of how much more weight should be assigned to the F1 difference.

In our case, one plausible weighting is to give the F1 difference twice the weight of the F2 difference because the former is relevant to both glide distance on the F1 * F2 plane and amplitude distance, while the latter concerns only the distance in formant frequency. We can then calculate the standard Euclidian distance using the formula (6). The final column of Table 14 lists the perceptual distance between onset and offset of each *y* diphthong obtained using this method.

(6) $Din(composite) = \sqrt{(2*(M1i - M1n))^2 + (M2i - M2n)^2}$

Table 14. Composite Perceptual Distance of each of the 'y + vowel' Sequences Obtained by Giving Twice as Heavy Weight to the F1 Difference as to the F2 Difference

Diphthongal sequences	2 * Perceptual F1 difference (Mel)	Perceptual F2 difference (Mel)	Perceptual distance from *i* (Mel)
*yi	0	0	0
*yɨ	136	372	396
ye	304	117	326
ya	750	441	870
yə	524	602	798
yu	60	701	704
yo	232	727	763

The two proposed methods of calculating the composite perceptual distance produce very comparable results. Both identify *yi*, *yɨ*, and *ye* as the sequences whose onset and offset are the least perceptually contrastive. Both also select *ya* as the most optimal 'glide + vowel' sequence, as supported by the three surveys mentioned earlier. (These results, in turn, suggest that the weightings given in the current study to amplitude and formant frequency in the perception of diphthongs are reasonably correct.)

The sequences *yi* and *yɨ* are not possible sequences in Seoul Korean. When the languages' preference of those diphthongs whose onset and offset are maximally (or sufficiently) perceptually different is considered, the results also suggest that *ye* (which has even less internal perceptual distinction than *yɨ*), is less perceptually stable than any other *y* diphthong of Seoul Korean. I would suggest that this is why, among the *y* diphthongs, *ye* alone is going through a monophthongization change. Seoul Korean speakers may have more difficulty perceiving the onglide *y* in the sequence *ye* than

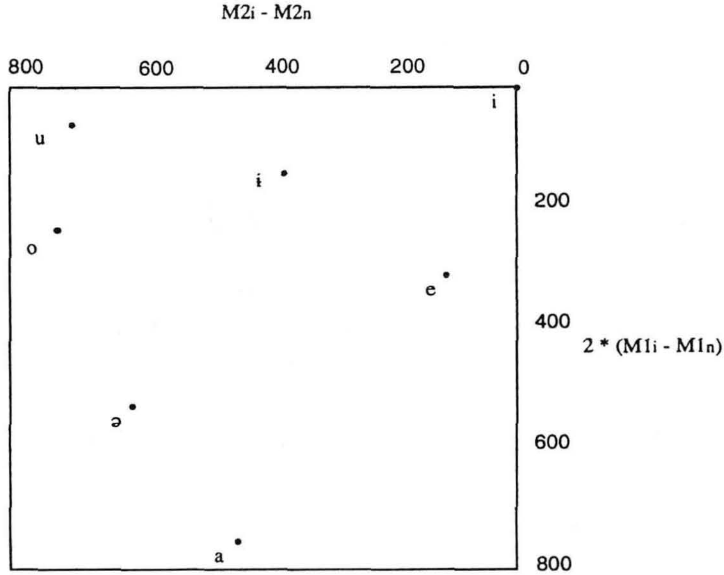

Figure 3. Seoul Korean Vowels on the Plane of Perceptual Distance from *i*

NB: The (x,y) Mel values for each vowel are from Table 14.

in the other '*y* + vowel' sequences because of the similarity between the two vocoids of this diphthong in their acoustic, auditory characteristics. The perceptual distance between onset and offset of the (logically) possible '*y* + vowel' sequences is visually shown in Figure 3, where the weighted differences in F1 and F2 of each vowel from *i* (these values are from Table 14) are located on the 'perceptual distance (from *i*)' plane. The figure shows that *e* has a significantly shorter perceptual distance from *i* than any other vowel that can follow *y* in Seoul Korean.

7. Conclusion

The present study has examined *y* deletion in Seoul Korean on the basis of a large-scale sociolinguistic database. It was first shown that Seoul Korean has two distinct processes of *y* deletion: categorical and variable *y* deletion. The first five sections of this paper focused primarily on the variable deletion. An attempt was made to reveal the linguistic and external constraints which condition this variable process relying mostly on statistical evidence. The results of the statistical analyses suggested that *y* deletion is not just a synchronic process but also a linguistic change in progress.

An attempt was also made to provide a phonological account of two processes of *y* deletion. It was suggested that two different OCP constraints trigger *y* deletion in Seoul Korean. It was also proposed that the strengths of these two OCP constraints are rather different: the stronger one triggers the categorical deletion, while the weaker one triggers the variable deletion.

A phonetic account of the ongoing monophthongization of *ye* was made as well. It was claimed that *ye* is perceptually the most unstable among the *y* diphthongs of Seoul Korean. This suggestion was based on the finding that *e* is perceptually the closest to *i* in the perceptual vowel space constructed considering both amplitude and formant frequency, the two acoustic parameters most relevant in the perception of diphthongal sequences. It was argued that the ongoing monophthongization of *ye* in Seoul Korean is motivated primarily by auditory, perceptual factors (Ohala 1981).

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Appendix 1. Potential Tokens of (y) in Sentence and Word Lists

1. sentence list: pangkye, yeɨi, yesul, yeən, phyehe, ɨiyekwa, phyehə, phyeki, kyesunamu, yessalam, kyelyangki, yep'ɨke, kyeki, ɨilye, chəlphye, kungye, suye, hwaphye, kyetan, conphye, yuphye, yonglye, colye, ɨnhye, hyean, hyehwamun

2. word list: ɨnhye, yesul, kyeki, kyelyangki, hwaphye, cihye, yuphye, hyesəng, mulye, hyehwamun, pangkye, mokye, phyehə, ɨiyekwa, suhyeca, hunkye, yeən, colye, caphyecɨng, phyehe, kyesunamu, ɨilye, conphye, yonglye, yemin

Appendix 2. Goldvarb Probabilities for Factors for Post-consonantal *y* Deletion (1st Run)

Factor Groups	Factors	Weight	%Applications	Total N
*Preceding C	p^h	.503	90	527
	k	.688	96	805
	k'	.625	97	75
	h	.747	95	351
	l	.076	70	70
	ɾ	.141	81	182
	n	.076	70	154
	ŋ	.096	73	78
*Syllable Position	initial	.294	91	958
	noninitial	.658	89	1284
*Speech Style	ingroup	.637	96	141
	interview	.616	95	280
	sentence R	.535	91	898
	word R	.409	86	923
Gender	male	.502	90	1165
	female	.498	89	1077
*Social Status	upper	.419	87	788
	middle	.534	91	764
	lower	.556	91	690

Factor Groups	Factors	Weight	%Applications	Total N
*Age	16-25	.630	94	801
	26-45	.603	94	687
	46+	.280	82	754

number of cells: 489 total x^2 = 588.3383 x^2/cell = 1.2031
loglikelihood = -586.667 Input = .945 Overall deletion rate = 90%

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