

A UNIFIED PHONETIC STUDY OF KOREAN STOP CONSONANTS

by

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0 Introduction

0.1 The purpose of this paper is to investigate the consonant sound system of Korean, particularly the nature of the stop consonants, from the standpoint of "unified phonetics"⁽¹⁾ in other words, to analyze and describe the sounds genetically as they are produced by the movement of speech-organs, and genemically as the sounds are interpreted in terms of their acoustic phenomena after they have been produced. This sort of unified approach to the study of speech sounds comprises all possible approaches such as acoustic, articulatory and "kinesiologic."⁽²⁾

0.2 The reasons for this unified approach are that if we employ only one method of analysis, say, the acoustic approach, our classification and description of the sounds would be confined only to the problems of pitch, volume, resonance and duration; that is to say, acoustic problems from the standpoint of the perceptual effect produced by these sounds upon the auditory mechanism. Under such a scheme, speech sounds are first classified into vowels and consonants. The sounds are further subdivided according to their auditory characteristics such as sonants and surds, sibilants or fricatives, affricates, plosives, nasals, liquids, trilled, clicks, aspirated, whispered, voiced or unvoiced. However, on the acoustic basis of resonance, pitch, and duration, we can hardly draw a clear-cut line between vowel and consonant, or distinctive and non-distinctive features of the sounds. In addition, the extent

(1) The term "unified phonetics" was first proposed by Kenneth L. Pike in his treatment of the acoustic analysis of a speech sound. See his *Acoustic Phonetics*, Lang. Monograph, 1948 p. 8.

(2) For detailed discussion of "kinesiologic," see Claude E. Kantner and Robert West, *Phonetics*, (NY 1933), pp. 13—38. To be brief, the kinesiologic approach is mainly concerned with the movement of the organs of speech during the production of a given sound.

of observation is haphazard, its accuracy doubtful. For this reason, the acoustic approach to the study of speech sounds often tends to become impressionistic, if not unscientific. Accordingly, we have to define our terms (here the vowels and the consonants) on the basis of function as well as sonority. In the adoption of acoustic description of a sound, we are concerned solely with the gross acoustic features that make up a distinctive sound, by virtue of which we can discriminate the distinctive features from the nondistinctive in the same language.

0.2.1 Next, to make our description more scientific, we can take up the study of speech sounds from the standpoint of the articulatory mechanism when the sounds are produced. The study of sounds so performed is called the "placement or articulatory" approach. The sounds under this scheme are defined in terms of the position of the tongue, soft-palate, mandible, lips, lower teeth in relation to their corresponding places of articulation. Thus, labio-labial (or bilabial), apico-dental and dorso-velar are some of the descriptive terms in the light of articulatory phonetics. However, this articulatory approach is possible when and only when we assume that the speech sounds are static and occur in isolation. In actuality, our speech sounds are not static entities but rather perceptual fragments of significant sounds in a moving continuum. From this viewpoint, our last concern is automatically directed to the movement of the speech mechanism in connection with the positions of articulation during the formation of a sound.

0.2.2 The sounds classified in the kinesilogic approach are only a few in descriptive terms. They are stops, glides and continuants. The kinesilogic approach is very important for the purpose of describing phonetic fluctuations, for it is mainly concerned with essential movements of speech organs with respect to the fluctuations of sounds in their environments. The above approaches are so closely related to one another that it is almost hopeless to analyze or describe a speech sound in a successful way without considering it as an organic whole, which I would like to call a "unified approach" to the study of speech sounds.

0.3 In the description of the consonant sounds in this paper, the unified approach is employed; however, for an analysis of the sounds in Korean this approach still does not provide us with an adequate method of analysis. A language like Korean requires a special method of analysis such as "componential analysis" ⁽¹⁾ or a method of "binary two-valued

(1) The componential analysis was first attempted by Zellig H. Harris. See his "Simultaneous Components in Phonology", reprinted in *Readings in Linguistics*, ed. by Martin Joos, (NY 1958), pp 124-138.

oppositions.”⁽¹⁾ This is because the voiceless consonant sounds in Korean are particularly characterized by the accompaniment or non-accompaniment of such simultaneous components as aspiration or glottal tension. Still, from another point of view, a simple voiceless consonant sound stands in contrast with its non-simple cognate in that the non-simple sound is composed of a simple sound plus one of the two significant components aspiration and tension. This may be best described in terms of binary two-valued oppositions.

0.4 This paper is divided for convenience into three sections: introduction, the consonant system of Korean, and the Korean stop consonants.

1. Outline of the Consonant System of Korean

1.1 **Characteristics.** The consonant sound system of Korean is markedly different from that of English in many ways, particularly in its “articulatory components”;⁽²⁾ that is to say, in the formation of Korean consonants such features as voicing and unvoicing are not significant as in English. In Korean these are only non-distinctive features that usually take place in the intervocalic positions of a word or a succession of words. In principle, the Korean consonant phonemes are all voiceless with the exception of the lateral and three nasals.

1.2 **Consonant components.** There are nine important components in the formation of the Korean consonants: labial closure (P), dental closure (T), alveolar or prepalatal affrication (C), sibilance (S), velar closure (K), aspiration (H), glottal tension (Q), nasality (N), and lateral opening (L).⁽³⁾ These components occur in nineteen coextensive sequences and they bring about 19 consonant phonemes or “units of distinctive sound-features”⁽⁴⁾ as follows:

(1) By the method of binary two-valued oppositions is meant a method of classification or description of sounds in terms of two-valued contrasts, such as voiced/voiceless, rounded/unrounded, aspirated/unaspirated, etc. This operational idea was first introduced to the study of phonology by Roman Jakobson, and was further developed by Fant and Halle. See Jakobson, R., Fant, C.G.M., and Halle, M. *Preliminaries to Speech Analysis*, (MIT 1951).

(2) By the articulatory components, I mean the properties of phonemic components such as primary articulatory features and secondary articulatory features. For further discussion, see Zellig S. Harris. *Structural Linguistics*, (Chicago 1947), pp. 125—49.

(3) Samuel E. Martin. “Korean Phonemics,” *Lang.* 27.4-Oct-Dec-1951, p. 523.

(4) Leonard Bloomfield. *Language*, (Chicago 1933), p. 79. “A minimum unit of distinctive sound-feature, a phoneme”

	P	T	C	S	K	-
-	p	t	c	s	k	#
H	ph	th	ch		kh	h
Q	pq	tq	cq	sq	kq	
N	m	n			ɳ	
L		l				

(A Table of the Korean Consonant Phonemes from the Viewpoint of Componential Analysis: Martin, Korean Phonemics, *Lang.* 27. 4-10-12-1965, p. 523)

Of these, the articulatory closure or opening determines a consonant sound as to its point of articulation, and the co-articulatory features such as aspiration, glottal tension, sibilance and affrication characterize the sounds with respect to their acoustic quality.

Out of the nine consonant components, however, strong aspiration and glottal tension are the distinctive features in the formation of stops, affricates and sibilants in the Korean language, because the simple consonants accompanied by these features bring about totally different consonant phonemes. Therefore, such components as aspiration and glottal tension, as against simple sounds, are significant characteristics in the formation of voiceless consonants, in that they are phonemic features. Other components such as manner of articulation or points of articulation are, of course, important as the foregoing two co-articulatory components; however, these "positions of articulation" ⁽¹⁾ are taken here simply as a part of the criteria of description of a sound. This is because the primary articulatory components are generally taken for granted as universally fundamental components for the production of speech sounds of any languages of the world.

1.3 Binary Opposition as a Simple Operational Analysis. The Korean consonants, therefore, can be grouped roughly into two large categories according to the articulatory components; namely, a group of "simple" consonants and a group of "non-simple" or "complex consonants". The classification or description of these consonant sounds may be performed best by the binary opposition of the "simple" and "complex" nature. Simple consonant phonemes are characterized by the lack of conspicuous co-articulatory components, whereas non-simple or complex ones are characterized by the composition of the two components: aspiration and glottal tension. In Korean, the simple consonant phonemes are in contrast

(1) Positions of articulation are labeled by a compound term: the articulators and the points of articulation. See Charles F. Hockett, *A Course in Modern Linguistics*, (NY 1962), p. 69.

with the complex consonant phonemes, particularly in the series of stops and affricates and sibilants, that are all voiceless. The Korean voiced consonant phonemes such as the lateral /l/ and three nasals /m n ŋ/ are all simple sounds; that is, these sounds are made up of primary articulatory components, not of tension or aspiration. The voiced consonant phonemes in Korean, therefore, do not have such cognate sounds as tension and aspiration.

1.4 Formation. Stops, affricates and sibilants are all voiceless in Korean, and they have aspiration and tension cognates. There are three phonemes in a series of simple stop consonants: /p/, /t/, and /k/. If these sounds are made with one of the two co-articulatory components, say, aspiration, then they produce entirely different phonemes to be symbolized by /ph/, /th/, and /kh/ respectively. When these sounds are accompanied by glottal tension, they bring about tension series of stop phonemes, which may be represented by the geminate symbols: /pp/, /tt/, and /kk/.

The /c/ is an affricate phoneme in Korean, which again patterns exactly like the stop phonemes with aspiration and tension; therefore, /ch/ is an aspiration-affricate phoneme and /cc/ is a tension-affricate phoneme. .

The /s/ is a simple sibilant consonant phoneme in Korean, whose complex cognate is /ss/. Now, from the standpoint of the principle of phonetic symmetry,⁽¹⁾ there is a hole in our pattern for the aspirated sibilant phoneme /sh/ does not exist in the series of sibilant consonants. However, this will be resolved when we know that aspiration never changes the nature of a sibilant sound even though it may intensify the force of sibilance. Sometimes the /s/ phoneme fluctuates into [ʃ] sound under the influence of the immediately following /i/ or /ü/ sound; however, in the light of the phonemic principle, such a conditional variation of a sound as this cannot be endowed with a privilege of an independent phoneme. [s] is an allophonic feature of the /s/ phoneme in Korean which is conditioned by its phonetic environment. Until the establishment of phonemic theory, there have been various disputes among the phoneticians about the recognition of the sound [s] as a phoneme in Korean. No doubt their arguments were personal and accidental for they must

(1) Phonetic symmetry is one of the six phonemic principles, according to Hockett, by which a sound is to be analyzed either into a phoneme or into an allophone. See Hockett's "A System of Descriptive Phonology," *Lang.* 18.3-21-1942, reprinted in *Readings in Linguistics* p. 100. It is also one of the four phonemic premises of Pike. See Pike's *Phonemics*, p. 59.

have based their discourse merely on the acoustic features which they observed regardless of that whether the sound features were functionally distinctive or not.

The Korean /h/ is a voiceless, heavily aspirated, simple glottal fricative sound, and it is one of the important consonant components. However, it is to be remembered that the phoneme /h/ is different from the co-articulatory component [h].

From the result of the above analysis, we become aware that the voiceless consonant sounds of Korean consist of three groups of different consonant components: simple, aspiration, and glottal tension. These may be best illustrated in a chart as follows:

simple	p	t	s	c	k	h
aspiration	ph	th		ch	kh	
tension	pp	tt	ss	cc	kk	

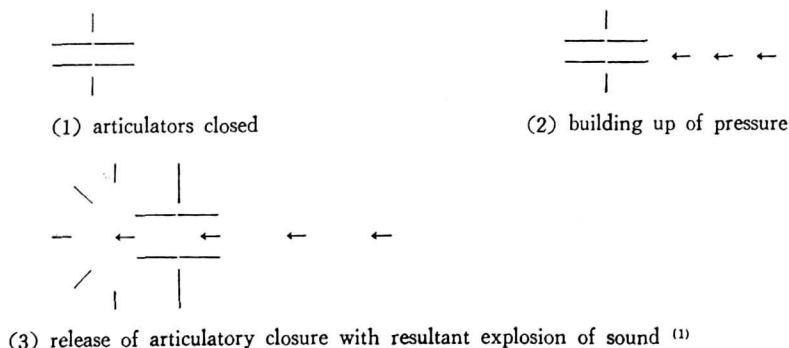
A clear-cut picture of the consonant sound system of Korean, then, would look somewhat like the following:

		bi-labial	apico-dental	apico-alveolar	lamino-palatal	dorso-velar	glottal
Simple:	Stop	p	t		c	k	
	Spirant			s			h
	Nasal	m	n			ŋ	
						
		Lateral		l			
Complex: Vl.							
Stop:	aspiration	ph	th		ch	kh	
	tension	pp	tt		cc	kk	
	aspiration						
	Spirant:						
		tension		ss			

2. Korean Stop Consonants

2.1 Characteristics of Stop Consonants. Like all stop sounds the stop consonants of Korean are also characterized by the three stages of formation: (1) the complete occlusion of the egressive breath stream by the closure of articulators at the respective points of

articulation, (2) the building up of pressure in the oral cavity, and (3) the sudden release of the articulatory closure with aspiration or with glottal tension. These three stages are aptly illustrated by A.J. Bronstein as in the following diagram:



When the stoppage of the breath stream results from the closure of the two lips, we get the /p/, /ph/, and /pp/ sounds. When the tip of the tongue is in contact with teeth ridge, the sounds /t/, /th/ and /tt/ are produced depending on the kinds of resultant co-articulatory features such as aspiration and glottal tension or without such features in a perceivable degree. In forming the sounds /k/, /kh/, and /kk/, the back of the tongue and the velum play an important role in accord with the three characteristic stages for the articulation of a stop.

2.2 Classification. From the “genemic” ⁽²⁾ viewpoint, the stop consonants in Korean are always non-syllabic speech sounds; that is to say, they have no resonance characteristics analogous to those of the vocalic sounds. In principle, the plosive consonant sounds in Korean are all of voiceless nature. However, we usually notice that the simple stop sounds are vocalized in a specific phonetic environment of intervocalic position. With the result of this phonetic fluctuation, the sounds /p/, /t/ and /k/ slur into the voiced sounds of [b], [d] and [g] respectively. The remaining complex stop consonants are always voiceless regardless of their environments. Another particular phonetic phenomenon is that all stop conso-

(1) Arthur J. Bronstein, *The Pronunciation of American English, An Introduction to Phonetics*, NY1960), p.67,

(2) The term “genemic” or “genetic” was first used by Panconcelli-Calzia in their *Experimentelle Phonetik*, p. 7. By “genemisch” is meant “concerning the product” and by “genetisch” concerning the production. Heffner defines these terms from the viewpoint of acoustic and articulatory phonetics respectively.

nant sounds, including affricates and sibilants, are unreleased without any exception in the final position of a word. Thus, we hear such phones as [p̚], [t̚], and [k̚] word-finally.

"Genetically," ⁽¹⁾ the plosive sounds under consideration are all stop consonants for they are produced by the complete closure of the air passage by which the breath stream flows from the larynx to the mouth. The characteristics of the formation of these sounds are explained in the preceding section. One thing must be mentioned particularly in connection with the third stage of the formation of the Korean stop consonants is that the simple sounds are emitted as weak, or lenis, sounds, whereas complex sounds are accompanied by a vigorous puff of air or glottal tension so that the resultant complex stop sounds are strong, or fortis. The acoustic impression of the lenis stop sounds in Korean may be the same as the devoiced sounds such as [b̥], [d̥], and [g̥] for the Korean /p/, /t/, and /k/.

Now, the above analysis of the stop consonants of Korean may be classified into several types of sounds, though they are ultimately the same, depending upon different approaches to the study of speech sounds.

From the standpoint of the placement approach, they are classified as follows:

- (1) Labio-labial stop: /p ph/ pp/, [b p̚] (allophones)
- (2) Apico-dental stop: /t th/ tt/, [d t̚] (allophones)
- (3) Dorso-velar stop: /k kh kk/, [g k̚] (allophones)

From the acoustic viewpoint, the above sounds may be classified and described as follows:

- (1) /p/.....a voiceless, lenis, impulsive, unaspirated, simple, pressure plosive consonant, its acoustic impression being the same as the devoiced [b̥] sound.
- (2) /t/.....a voiceless, lenis, impulsive, unaspirated, simple, pressure plosive consonant, its acoustic impression being the same as the devoiced [d̥] sound.
- (3) /k/.....a voiceless, lenis, impulsive, unaspirated, simple, pressure plosive consonant, its acoustic impression being the same as the devoiced [g̥] sound.
- (4) /ph/..... a voiceless, fortis, impulsive, aspirated, complex, pressure plosive consonant.
- (5) /th/..... a voiceless, fortis, impulsive, aspirated, complex, pressure plosive consonant.
- (6) /kh/..... a voiceless, fortis, impulsive, aspirated, complex, pressure plosive consonant.
- (7) /pp/..... a voiceless, fortis, impulsive, glottalized, complex, pressure plosive consonant.
- (8) /tt/..... a voiceless, fortis, impulsive, glottalized, complex, pressure plosive consonant.

(1) R-M. S. Heffner, *General Phonetics*, (Madison 1960), pp. 1-3, 116-118.

- (9) /kk/..... a voiceless, fortis, impulsive, glottalized, complex, pressure plosive consonant.
- (10) /b/..... an allophone of /p/, whose difference in acoustic value from that of /p/ is voicing.
- (11) /d/..... an allophone of /t/, whose difference in acoustic value from that of /t/ is voicing.
- (12) [g]..... an allophone of /k/, whose difference in acoustic value from that of /k/ is voicing.
- (13) [pʰ]..... an allophone of /p/ characterized by unreleasing.
- (14) [tʰ]..... an allophone of /t/ characterized by unreleasing.
- (15) [kʰ]..... an allophone of /k/ characterized by unreleasing.

In terms of the kinesiological approach, all the plosive consonant sounds can be called a "stop sound" because this approach is primarily concerned with the types of movements involved. Again, in view of the movement of the speech organs correlating with the formation of a sound, we can say that stop consonants are no more than perceptual fragments of significant sounds in a moving continuum initiated and formed by the movement of the speech mechanism. They are formed from the neutral position of articulation if they occur utterance initially and thus function as an approaching sound, an on-set. They may also function as a receding sound or off-set if they terminate an utterance. As a matter of fact, a sound, in such a rapid flow of speech, always tends to be modified by its adjacent sounds. This sort of phonetic fluctuation of sounds may be best explained in terms of the kinesiology approach provided that we are wholly devoid of the theory of phonemic analysis.

Still from the physiological standpoint, the stop consonant sounds of Korean may be grouped into several categories as follows:

- (1) The Beta consonant: /p ph pp/, [b pʰ] (allophones)
- (2) The Delta consonant: /t th tt/, [d tʰ] (allophones)
- (3) The Gamma consonant: /k kh kk/, [g kʰ] (allophones)

The nomenclature for these sounds ⁽¹⁾ is rather symbolical; yet, for a discovery of the reasons for sound changes, or, more specifically, for a scientific prediction of the interfer-

(1) Kantner and West, *Phonetics*, p. 218. They classified the speech sounds into five physiological groups: Beta, Delta, Gamma, Centrally Delivered Vowels, and Laterally Delivered Vowels.

ence of sounds on the part of a student learning a foreign language, this sort of grouping of sounds proves to be of great significance. This shows us that sounds are often fluctuating into one another within the domain of the physiologically similar processes. For example, in the phonetic fluctuation of the Korean /p/ series, there takes place the "Beta interchangings"; in other words, the changes are within the range of Beta consonants. More precisely speaking, the sound changes occur within the homorganic sounds (here, the labial sounds: [p], [p'], [p''], [b] or [p'']). Because the labial sounds involve an activity of the lips and they are physiologically similar to one another. Some of the common Beta sound changes predictable on this ground are v/b, m/b, b/p, b/f, m/p, p/f, f/v, b/v, and f/Ø.

This method of analysis also provides us with an important cue to explain the reasons for possible sound changes that may take place within the range of homorganic sounds existing in the same language.

On the analogy of the Beta sound changes we can easily predict what sort of Delta sound changes will take place in Korean. No doubt they are [t], [t'], [t''], [d], and [t'']. The same analogy holds true with the Gamma consonants. In fact, exactly the same pattern of sound changes occurs with them, the changes being [k], [k'], [k''], [g], and [k''].

2.3 Criteria of Description. Heffner (p. 123—4) sets up 4 criteria of description with a few sub-criteria under each one. They are:

- (a) One must state whether it is voiceless or voiced. If voiced, it may be desirable to say how much and what part of the total length of the stop has voicing. If voiceless, it is desirable to say whether it is fortis or lenis.
- (b) One must indicate whether its release is impulsive (i. e., sudden) or affricative, and if impulsive, whether it is aspirated or unaspirated.
- (c) One must say whether it is a simple, an intermittent, or a compound, whether it is glottalized or velaric.
- (d) And finally, one must indicate whether it is a pressure or a sudden stop.

On the basis of these criteria, we can describe only the acoustic features of a sound as was shown in the foregoing section. From the standpoint of articulatory phonetics, these criteria are not sufficient for being complete. Moreover, from the point of view of phonemics or kinesiological approach, the above criteria do not give us a full guarantee that whether or not a discrimination should be made between the distinctive and non-distinctive features of a sound, and that they do not tell us whether or not the physiological reasons

for the sound changes are important and thus should be included in the description of a sound.

To meet the requirements of my approach, therefore, I would like to add two more statements to the above criteria for describing a sound:

(A) One must describe first of all the minimum units of the distinctive sound-features in the most complete and simplest way possible, and state all the non-distinctive features or allophones wherever they occur in relation to their respective phonemes.

(B) One must describe a sound in terms of the placement of articulators.

If we apply the above criteria, the Korean stop consonants would be described somewhat like the following.

2.4 Labio-labial or Bilabial Stop Consonant. There are three distinctive sounds in labio-labial stop category. They are /p/, /ph/, and /pp/. The formation and the description of these sounds are as follows:

/p/.....is a voiceless, lenis, impulsive, aspirated, simple, pressure, bilabial stop (or plosive) consonant.

/ph/is a voiceless, fortis, impulsive, aspirated, complex, pressure, bilabial stop (or plosive) consonant.

/pp/is a voiceless, fortis, impulsive, glottalized, complex, pressure, bilabial stop (or plosive) consonant.

The characteristic formations of these sounds are explained in the preceding pages (see Chapter 1).

All three sounds can occur initially, medially, and finally in a word; however, they normally undergo a regular phonetic change if they occur in a special phonetic environment.

2.4 For /p/ alternations.

a. /p/ is unreleased word finally; i. e., *unreleasing*.

e. g.	/pap/	[pap ^ɿ] (food)
	/ip/	[ip ^ɿ] (mouth)
	/thap/	[t ^h ap ^ɿ] (tower)

b. /p/ is voiced intervocalically; i.e. *voicing*.

e. g.	/kipek/	[kibek ^ɿ] (animation)
	/sapal/	[sabal] (bowl)

/sepyɔk/ [sebyɔkʷ] (dawn)

- c. /p/ is fortified with glottal tension if it is immediately followed by another /p/; i.e., "*fortition*"⁽¹⁾

e. g.	/kip-pi/	[kip'i]	(scholarship)
	/ip-pɔp/	[ip'ɔpʷ]	(legislation)
	/nap-pu/	[nap'u]	(payment)

In this case, however, the first /p/ is usually unreleased for a perceivable period of time and in return the following /p/ is intensified with glottal tension. This sort of phenomenon is particularly noticeable in slow speech, the phonetic notation of which would be somewhat like the following.

[kipp'i]
[ipp'ɔp]
[napp'u]

- d. /p/ becomes /m/ if it is immediately followed by /m/; i.e., *assimilation*.

e. g.	/ip-mat/	[immatʷ]	(appetite)
	/cap-mal/	[cammal]	(gossip)
	/sip-man/	[šimman]	(ten thousand)

- e. /p/ is aspirated if it is followed by /h/; i.e. *aspiration*.

e. g.	/cip-hap/	[cip'ap]	(gathering)
	/nap-ham/	[nap'am]	(shouting)
	/tap-hata/	[tap'ada]	(to answer)

- f. /p/ is dropped before complex consonants (aspiration); i.e., *reduction*.

e. g.	/sip-phal/	[sip'al]	(eighteen)
	/kap-phan/	[kap'an]	(deck)
	/kap-phi/	[kap'i]	(uppers of a shoe)

2.4.2 For /ph/ alternations.

- a. /ph/ is unreleased word finally; i.e., *unreleasing*.

e. g.	/suph/	[supʷ]	(forest)
	/iph/	[ipʷ]	(leaf)
	/cipph/	[cipʷ]	(straw)

(1) FORTITION is one of the five alternative types in Korean: reduction, assimilation, metathesis, fortition, and reinforcement. See Martin's *Korean Morphophonemics*, (LSA, 1954), p. 52.

This is because in Korean all consonant sounds are believed to be unpronounceable unless they are followed by a vowel sound with the exception of the voiced consonants. The voiced consonants are pronounced even in the word final position with their full acoustic value. However, one particular feature we have to notice as to the nature of the complex consonant sounds in Korean is that the complex consonants usually contribute considerable loudness (phonemically non-distinctive accent feature) to a syllable in which they occur because of their fortis nature of articulation. Due to the fortis nature of articulation they are seldom modified by their adjacent sounds.

2.4.3 For /pp/ alternations.

- a. /pp/ never occurs finally and does not slur into another sound nearby. The manner of articulation for this sound is almost the same as for the /p/ sound in French except that the muscular tension is more conspicuous around the lips in the formation of the Korean /p/ sound.

2.5 Apico-dental Stop Consonant. There are three distinct sounds in the apico-dental stop category. They are /t/, /th/, and /tt/. The formation and the description of these sounds are as follows:

/t/.....is a voiceless, lenis, impulsive, unaspirated, simple, pressure, apico-dental(or alveolar) stop consonant.

/th/is a voiceless, fortis, impulsive, aspirated, complex, pressure, apico-dental(or alveolar) stop consonant.

/tt/is a voiceless, fortis, impulsive, glottalized, complex, pressure, apico-dental (or alveolar) stop consonant.

The formations of these sounds are similar to those of the allophones of the English /t/ sound except that the Korean /t/ is made as a weak sound, the /th/ is more heavily aspirated than the English /t/ sound, and the /tt/ in Korean is accompanied by glottal tension as well as muscular tension around the mouth. Therefore, the acoustic image of the Korean /t/ is more like the [b] than the usual /t/ sound of English. The /th/ is almost like the English aspirated [tʰ] sound in the stressed syllable, and the /tt/ is more or less similar in acoustic image to the French /t/ than it is to the English /t/ sound. The particular formations of these sounds are already mentioned in Chapter 1. The sounds /t/ and /th/ occur in the initial, medial and final positions of a word but the /tt/ sound occur

only initially and finally. The reasons for this exception have been explained in the foregoing section. In many ways, /t/ patterns like the /p/ sound in its particular phonetic environments.

2.5.1 For /t/ alternations.

a. /t/ is unreleased word finally; i.e., *unreleasing*.

e. g.	/pat-/	[pat ^ɿ] (verb stem of "receive")
	/tat-/	[tat ^ɿ] (" " "shut")
	/mut-/	[mut ^ɿ] (" " "bury")

b. /t/ is voiced intervocalically; i.e., *voicing*.

e. g.	/pata/	[pada] (sea)
	/kilta/	[kilda] (long)
	/potap/	[podap ^ɿ] (repay)

c. /t/ is fortified with glottal tension if it is immediately followed by another /t/; i.e., *fortition*.

e. g.	/pat-ta/	[pat'a]—[pat ^ɿ ·tta] ⁽¹⁾ (receive)
	/tat-ta/	[tat'a]—[tat ^ɿ ·tta] (shut)
	/mut-ta/	[mut'a]—[mut ^ɿ ·tta] (bury)

d. /t/ becomes /n/ before /n/; i.e., *assimilation*.

e. g.	/pat-nin/	[pannin] (adjectival of "receive")
	/tannin/	[tannin] (" " "shut")
	/mut-nin/	[munnin] (" " "bury")

e. /t/ becomes /ch/ before /h/; i.e., *assimilation*.

e. g.	/pat-hita/	[pac'ida] (be struck)
	/mut-hita/	[muc'ida] (be buried)
	/tat-hita/	[tac'ida] (be shut)

2.5.2 For /th/ alternation.

a. /th/ is unreleased word finally; i.e., *unreleasing*.

e. g.	/path/	[pat ^ɿ] (field)
	/mith/	[mit ^ɿ] (bottom)

(1) The forms [pat^ɿ·tta], [tat^ɿ·tta] and [mut^ɿ·tta] occur in slow speech.

/kkith/

[k'itʰ]⁽¹⁾(end)

2.5.3 For /tt/ alternation.

- a. /tt/ never occurs finally and does not slur into another sound nearby. The manner of articulation for this sound is almost the same as for the /t/ sound in French except that the muscular tension is more conspicuous around the lips in the formation of the Korean /tt/ sound.

2.6 **Dorso-velar Stop Consonant.** There are three distinctive sounds in the dorso-velar stop category. They are /k/, /kh/, and /kk/. The descriptions of these sounds are as follows:

/k/.....is a voiceless, lenis, impulsive, unaspirated, simple, pressure, dorso-velar stop (or plosive) consonant.

/kh/is a voiceless, fortis, impulsive, aspirated, complex, pressure, dorso-velar stop (or plosive) consonant.

/kk/is a voiceless, fortis, impulsive, glottalized, complex, pressure, dorso-velar stop (or plosive) consonant.

The formations of these sounds are almost the same as the articulations of the allophones of the English /k/ sound, the only difference between the English /k/ allophones and the Korean /k/ phonemes being that the non-distinctive features in English such as aspiration and glottal tension are distinctive features in the formation of the /k/ phonemes in Korean. The sounds /k/, /kh/, and /kk/ occur in all positions: initial, medial, and final. However, they are also bound to phonetic fluctuations if they occur in a particular environment.

2.6.1 For /k/ alternations.

- a. /k/ is unreleased word finally; i.e., *unreleasing*.

e. g.	/kok/	[kokʰ] (tune)
	/tok/	[tokʰ] (poison)
	/puk/	[pukʰ] (drum)

- b. /k/ is voiced intervocally; i.e., *voicing*.

e. g.	/so-kok/	[sogokʰ] (short piece)
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(1) The phonetically unreleased parts of the morphs {patʰ}, {mitʰ} and {k'itʰ} resume their phonetic value if followed by a vowel: e.g., [patʰ+e]→ [pat'e] (on the field,) [mitʰ+e]→ mit'e (at the bottom), [k'itʰ+e]→ [k'it'e] (at the end), etc. The same morphophonemic rule holds true with the rest of the finally unreleased consonants in Korean.

/so-ke/ [soɡe] (dispersion)

/sam-kak/ [samɡakʷ] (triangle)

c. /k/ is fortified with glottal tension if it is immediately followed by another /k/; i.e., *fortition*.

e. g. kak/-ki/ [kakʷ.kki]—[kak'i] (each other)

/yɔk-ki/ [yɔkʷ.kki]—[yɔk'i] (weight-lift)

/sik-ki/ [sikʷ.kki]—[sik'i] (table-ware)

d. /k/ becomes /ŋ/ before /m/ and /n/; *assimilation*.

e. g. /yuk-man/ [yʊŋman] (60,000)

/puk-mansan/ [pʊŋmansan] (cemetery)

/nɔk-nɔk-hata/ [nɔŋnɔk'ada] (plenty enough)

/me-kuk-no/ [megʊŋno] (traitor)

e. /k/ is aspirated before /h/; i.e., *aspiration*.

e. g. /pak-hata/ [pak'ada] (heartless)

/pak-he/ [pak'e] (persecution)

/mak-ha/ [mak'a] (staff)

2.6.2 For /kh/ alternation.

a. /kh/ is unreleased word finally; i.e., *unreleasing*.

e. g. /puɔkh/ [puɔkʷ] (kitchen)

/tɔpyɔkh/ [tɔpyɔkʷ] (eastward)

2.6.3 For /kk/ alternation.

a. /kk/ is unreleased word finally; i.e., *unreleasing*.

e. g. /pakk/ [pakʷ] (outside)

/kkakk-/ [k'akʷ] (verb stem of "cut")

/kyɔkk-/ [kyɔkʷ] (verb stem of "experience")

A more detailed discussion of the alternation of sounds goes beyond the scope of phonetics for it belongs to the realm of morphophonemics.

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