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A Study of Korean Learners' Perception of Plosives and Affricatives (Focusing on Uzbek Learners)

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Abstract

This study aims to provide basic data on Korean plosives and affricates pronunciation education by examining the perception and characteristics of Uzbek learners of Korean plosives and plosives according to their learning period. In order to identify Uzbek learners' perception of Korean, we examined the phonetic correspondence between Korean and Uzbek and conducted an experiment on learners' perception. We also examined the cognition of Uzbek learners who had never been to Korea before, and the cognition of Uzbek learners who started learning Korean after entering university. The results showed that Uzbek learners' perception of plosives and affricates was as follows: fortis (58%), aspirated (52%), and lenis (43%). Overall, lenis sounds were the least recognized, and there was a strong tendency to recognize word-initial sounds as aspirated sounds. The highest recognition rate was for fortis sounds. When it comes to the perception error patterns of aspirated sounds, they were more often recognized as fortis than lenis. When it comes to the recognition errors of fortis sounds, the learners were slightly more likely to recognize them as aspirated than lenis. When the learners were divided by learning period, the recognition rate of lenis and fortis improved significantly as the learning period increased, but the recognition rate of aspirated tended to decrease in learners with more learning experience.

Keywords: *Affricate; Korean Pronunciation; L2 Speech Perception; Plosive; Uzbek Korean Learner*

1. Introduction

This study aims to examine Uzbek learners of Korean perception of word-initial plosives and affricates to see how they differ according to learners' first language and learning duration. Specifically, this study examines Uzbek learners' perception of the Korean plosives and affricates as a function of native language influence and learning duration by conducting a perception experiment on the 'lenis: fortis: aspirated' phonetic categories of Korean plosives and affricates.

Learners' accurate perception of the target language sounds is crucial to their ability to communicate with native speakers, which is the ultimate goal of language education. Unlike children, adult learners have difficulty acquiring foreign language sound because they come to a foreign language with the phonetic categories of their native language already formed. The ability to identify the phonemes

of the target language is the first step in learning a foreign language, so pronunciation training should be provided to help learners recognize them accurately [1].

According to statistics from the Korean Ministry of Education in 2023, Uzbekistan has the third largest number of international students in Korea (10,409) after China and Vietnam [2]. Nevertheless, Korean pronunciation studies have been conducted for Chinese, Japanese, Vietnamese, and English learners, and there is a dearth of research on Uzbek learners.

The preceding researches related to Korean pronunciation education for Uzbek learners were concentrically conducted in the 2010s. It is believed to be related to the increasing exchange between Korea and Uzbekistan. Among the papers related to pronunciation education, Park (2010) states that the most difficult aspect of Korean pronunciation for foreign learners is the distinction of 'lenis: fortis: aspirated' sounds [3]. The Korean consonant system is composed of three- -way stop of of 'lenis: fortis: aspirated', while Uzbek is divided into two-way stop of 'voiced and unvoiced', and the phonological differences between the two languages make it difficult to recognize and pronounce. The initial /ㅂ/, /ㅃ/./ㅍ/ in /불[bul] fire, /뿔[ppul] horn/, /풀[pul] grass/ are different phonemes that are 'lenis: fortis: aspirated' sounds but to Uzbek learners, they are likely to sound the same or be perceived as two different categories. In another previous study related to the teaching of Korean to Uzbeks, Yoo Seung-Man (2008b) presented the phonological system of Uzbek consonants and vowels, providing a foundation for research through the comparison of phonological systems between the two languages [4]. Shim, Hyunju, and Kim, Sunjung (2015) analyzed the characteristics of Korean plosives by conducting speech and listening experiments on Uzbek learners studying in Korea and found that they were unable to accurately distinguish between lenis and aspirated Korean plosives [5]. Jang, Hyun-Ah (2018) found that Uzbek learners of Korean had difficulty distinguishing between lenis and fortis sounds [6]. Ahn, Soohyun (2019) conducted perception and production experiments on Korean consonants and vowels of Uzbek learners and analyzed the produced pronunciations through acoustic-phonetic analysis to identify the learners' pronunciation errors and proposed a pronunciation teaching plan focusing on error compensation [7].

Previous studies have linked Uzbek learners' pronunciation errors to differences in their phonological system, and concluded that it is difficult for them to distinguish among lenis, fortis and aspirated sounds. These conclusions are mostly based on Korean learners in Korea and are not universally applicable to learners in their native language environment. It is difficult to determine whether similar conclusions can be drawn for Korean plosives and affricates in the native language environment, and whether they vary depending on the duration of learning in the native language environment.

This study aims to examine how the categories of plosives and affricates are organized in the cognitive system of Uzbek learners of Korean by focusing on the phenomenon of sound changes in Korean word-initial sounds. Specifically, it will investigate the perception of lenis, fortis and aspirated in Korean by learners' learning periods. The scope of the study is the Korean plosives and affricates with the word- initial position: bilabials /ㅂ[p],ㅃ[p′],ㅍ[p^h]/, alveolars /ㄷ[t],ㄸ[t′],ㅌ[t^h] /, and velar /ㄱ[k],ㄲ[k′],ㅋ[k^h]/, and the affricates /ㅈ[ʧ], ㅉ[ʧ’],ㅊ[ʧ^h]/. Through cognitive experiments, we will examine the effects of the voiced/voiceless opposition in Uzbek and the influence of learners' native language. We will also examine whether the perception improves as the duration of Korean learning increases.

2. L2 Speech Acquisition Theories

When acquiring target language speech, learners may have difficulty acquiring accurate speech due to the influence of L1. L2 encountered after the acquisition of L1 is interpreted based on the phonological structure of L1, resulting in different cognitive patterns with native speakers [1]. The

difficulty adult foreign language learners perceive and acquire depends on the degree of similarity between the mother tongue and the target language, and Best's Perceptual Assimilation Model (PAM) and Flege's Speech Learning Model (SLM) are representative theories in this regard.

2.1. Best's Perceptual Assimilation Model (PAM)

Best's Perceptual Assimilation Model is a model that focuses on speech recognition based on similarities between L1 and L2, and is primarily interested in how L1 phonetic categories affect the perception of L2 speech sounds. The idea is that when we listen to L2, we correspond L2 sounds based on our already formed L1 phonetic categories, and our identification of L2 speech depends on how each sound is corresponded [8]. Best categorized speech sound perceptual assimilation patterns into six types as shown in [Table1] below and predicted discrimination difficulties.

Table 1. Types of perceptual assimilation in PAM (Kwon, 2010b) [9]

Two-Category Assimilation (TC)	• Two non-native segments are assimilated into different native language categories. • Very easy for learners to distinguish
Category-Goodness Difference (CG)	• Two foreign sounds are assimilated into one and the same native language category, but the two sounds differ in the degree to which they deviate from the "ideal" of the native language. One sound is relatively more acceptable, while the other deviates slightly from the ideal. • Easy or normal for learners to identify.
Single-Category Assimilation (SC)	• Two foreign sounds are assimilated into one and the same native language category. Both sounds have the same degree of deviation from the native language norm. • Difficult for learners to distinguish
Both Uncategorizable (UU)	• Both foreign sounds are present in the speech area, but neither belongs to a native language category, so they are considered uncategorizable. • This is a type that can be very difficult or very easy to differentiate. It depends on how close the two sounds are to each other and how close they are to the native language categories within the native phonological region.
Uncategorized versus Categorized (UC)	• One foreign sound is assimilated into one native language category, but the other is recognized as a type outside of the native speech category. • Distinguishable types
Nonassimilable (NA)	• Both foreign language sounds are inconsistent with the native language category and are not recognized as speech. • Easily identifiable types

As shown in [Table 1], PAM believes that of the six types, the SC type is expected to be the most difficult to identify. This is when two foreign sounds are matched with one native speech sound, so that the foreign sounds are heard as one sound instead of two. On the other hand, if the two foreign sounds correspond to two native sounds (TC), or if one corresponds and the other is completely out of the category of the native sound (UC), we predicted that the discrimination difficulty would be easy because it is easy to distinguish between the two sounds. It is explained that these easy tones will be easily acquired, while difficult tones will be difficult to distinguish [1] [10] [11] [12].

2. 2. Flege's Speech-Learning Model (SLM)

Flege's Speech Learning Model (SLM) is a hypothesis that discusses the difficulty of acquisition based on similarity [12]. In the early stages of learning, the subtle differences between languages are not recognized due to the interference of the L1, but as the L2 experience accumulates, the differences between phonemes are greatly recognized and the pronunciation becomes accurate. This is due to the fact that Flege's SLM makes the duration of L2 experience a variable, which means that adult learners who start learning L2 after they have fully mastered L1 can still make progress in terms of phonetic acquisition. According to SLM, the elements that make up the phonetic underpinnings of L1 and L2 exist in a “common phonological space,” meaning that L1 and L2 mutually influence each other. L1 and L2 interact through two mechanisms: 'phonetic category assimilation' and 'phonetic category dissimilation' [13] [14] [15] [16].

Phonetic category assimilation is the mechanism that is activated when a new phonetic category fails to form despite the existence of perceptible differences between L1 and L2 speech. When phonetic category assimilation is triggered, the L1 and L2 voices merge, and the L2 voice remains similar to the L1 voice, i.e., the L2 voice is perceived and spoken according to L1 habits.

Phonetic category dissimilation is a mechanism that works when a new category is formed for L2 speech. This results in a restructuring of the L2 learner's phonetic field.

According to the degree of similarity between L1 and L2 speech, it is divided into three types: new phone-similar phone-identical phone. Of these three types, Flege predicts that new phones are the easiest to acquire. However, for similar phones, the similarity to L1 will hinder the formation of L2 equivalent phonetic categories. In other words, the closer the L2 voice is to the L1 voice, the less likely it is to be acquired, and the greater the distance between the two, the more likely it is to be acquired accurately [17].

2.3. Duration of L2 Experience

In general, studies have shown that the longer the duration of experience with an L2, the better the ability to accurately recognize L2 pronunciations that are not present in the native language. In this context, experience period is usually defined as the period of time spent living in the target language-speaking country [1]. Flege argued that while native-like phones do not change significantly with increasing exposure to a foreign language, new phones that are different from the native language are acquired better with increasing exposure. In this paper, we investigate whether Flege's claim can be applied to Korean learners who study Korean in a non-target language environment to shed light on how Korean speech perception changes with the duration of Korean learning.

3. Comparison of the Korean and Uzbek Plosive and Affricate Systems

3.1. Korean Plosive and Affricate System

Korean consists of 19 consonants. Among them, 9 plosives /ㄱ,ㄲ,ㅋ:ㄷ,ㄸ,ㅌ:ㅂ,ㅃ,ㅍ/ and 3 affricates /ㅈ,ㅉ,ㅊ/ are all voiceless sounds and are classified into lenes/ㄱ,ㄷ,ㅂ,ㅈ/, fortes/ㄲ,ㄸ,ㅃ,ㅉ/ and aspirated sounds /ㅋ,ㅌ,ㅍ,ㅊ/ according to their gastroticity and tension. lenis sounds are those that are articulated with neither air nor tension; fortis sounds are those that are articulated with tension but air; and aspirated sounds are those that are articulated with both air and tension. Consonants can be divided into voiced and unvoiced sounds according to whether the vocal cords vibrate or not, and non-aspirated and aspirated sounds according to whether they have a base or not. They are also divided into soft and hard sounds depending on whether the larynx is tense or not [18] [19] [20].

Table 2. Korean plosives and affricates system

Articulatory position / Articulation method	Bilabial	Alveolar	Palatal	Velar
Voiceless non-aspirated soft sounds	ㅂ[p]	ㄷ[t]	ㅈ[ʧ]	ㄱ[k]
Voiceless non-aspirated hard sound	ㅃ[p′]	ㄸ[t′]	ㅉ[ʧ’]	ㄲ[k′]
Voiceless aspirated hard sound	ㅍ[p^h]	ㅌ[t^h]	ㅊ[$ʧ^h$]	ㅋ[k^h]

3.2. Uzbek Plosive and Affricate System

The number of consonants in Uzbek is generally considered to be 23, of which 7 are plosives /P, B, T, D, K, G, Q/ and 2 are affricates /Ch, J/. The voiced /B, D, G, J/ and voiceless /P, T, K, Ch/ are categorized according to the presence or absence of vocal tract vibration [7].

Table 3. Uzbek plosive and affricate system

Articulatory position / Articulation method	Bilabial	Alveolar	Alveolo--palatal	Velar
Voiceless non-aspirated hard sounds	P[p]	T[t]	Ch[ʧ]	K[k]
Voiceled non-aspirated soft sound	B[b]	D[d]	J[ʤ]	G[g]

3.3. Features of Korean and Uzbek Plosives and Affricates

When comparing Korean and Uzbek plosives, there is no difference in articulatory position and articulation method, but Korean affricates /ㅈ, ㅉ, ㅊ/ and Uzbek affricates /Ch, J/ differ in that their articulatory positions do not match [7]. Korean plosives and affricates are divided into three types: lenis: fortis: aspirated sounds, depending on the degree of air and tension, whereas Uzbek plosives and affricates are divided into two types: voiced and unvoiced, depending on the presence or absence of vocal fold vibration.

Table 4. Uzbek learners' assimilation of Korean plosives

Korean	Uzbek
/ㅍ, ㅌ, ㅋ/	/p, t, k/
/ㅂ, ㄷ, ㄱ/	
/ㅃ, ㄸ, ㄲ/	/b, d, g/

Based on the assimilation patterns in [Table 4], both Korean lenis and aspirated sounds can be perceived as Uzbek voiceless sounds, and Korean fortis sounds can be perceived as voiced sounds. Therefore, it is not an easy task for Uzbek learners to recognize the lenis, fortis, and aspirated tones of Korean plosives.

4. Methodology

4.1. Subjects

The subjects of the cognitive experiment were students of the Korean language department at the Kimyo International University in Tashkent, Uzbekistan, including 10 first-year students, 10 second-year students, and 10 third-year students. To examine whether learners' cognitive patterns change with increasing learning duration and proficiency, we divided the subjects into first-year students with 7 months of Korean study, second-year students with 19 months of Korean study, and third-year students with 31 months of Korean study. All subjects had no previous Korean language learning experience before entering university and had never visited the target country, Korea.

Table 5. Subject Information

	1st Year	2nd Year	3rd Year
Number of participants	10	10	10
Age	19.3 (18-22)	19.9 (18-24)	20.5 (19-24)
Gender	M:2/F:8	M:3/F:7	M:0/F:10
Duration of study	7 months	19 months	31 months
Visited Korea	x	x	x

4.2. Experimental Methods

The cognitive experiment was conducted to determine the extent to which participants were able to recognize the sound changes of Korean word-initial plosives and affricates by listening to and choosing one of three words with the plosives /ㄱ, ㄲ, ㅋ; ㄷ, ㄸ, ; ㅂ, ㅃ, ㅍ/ and the affricatices /ㅈ, ㅉ, ㅊ/ three times. The test was administered by a native Korean teacher in a quiet classroom with no noise. Instructions on the content and methodology of the test were provided in Korean and Uzbek prior to the test.

5. Analysis

5.1. Perception Rates by Speech Types

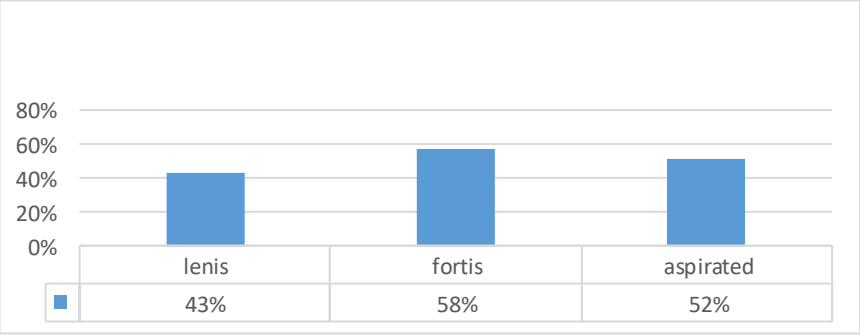

Figure 1. Percentage of perception for lenis, fortis, aspirated sounds

As in the〈Figure 1〉, across all groups, subjects recognized the highest percentage of fortis sounds (58%). This was followed by aspirated (52%) and lenis (43%). Uzbek learners of Korean have the lowest recognition rates for lenis of Korean word- initial plosives and affricates. However, we can see that lenis sounds have a significant improvement as the duration of study increases. On the other hands, in the case of aspirated sounds, the percentage of correct responses tends to decrease in the third grade.

5.2. Percentage of Perception of Lenis, Fortis, and Aspirated Sounds by Period of Study

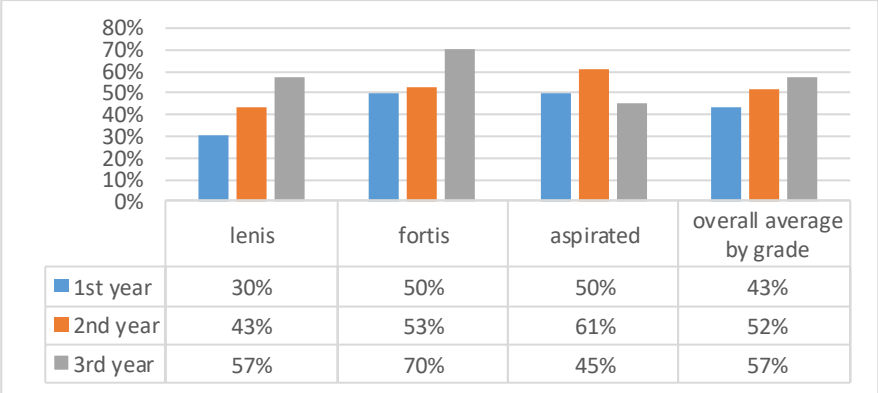

Figure 2. Percentage of perception of lenis, fortis, and aspirated sounds by period of learning

In〈Figure 2〉, when looking at the percentage of recognizing lenis, fortis and aspirated sounds by study period, overall, the percentage of correct responses increased as the duration of Korean study increased. However, when examined by speech type, recognition did not improve for all of them. For lenis and fortis sounds, the first, second, and third year students all showed an improvement in recognition, but for aspirated sounds, the percentage of correct responses actually decreased in the third year students. Recognition of lenis and fortis sounds steadily increased over the course of study, whereas recognition of aspirated sounds remained difficult regardless of the length of study. These results are in line with research showing that the ability to recognize and pronounce new sounds that are not present in the native language, improves with more L2 experience.

5.3. Analysis of Cognitive Modality by Learning Period

5.3.1. Analysis of Lenis Sounds Recognition Patterns by Learning Period

Table 6. Lenis sounds recognition patterns by learning period

lenis		1st year	2nd year	3rd year	note
ㄱ	lenis ㄱ	20	45	60	No answer 1
	fortis ㄲ	20	25	10	
	aspirated ㅋ	50	30	30	
ㄷ	lenis ㄷ	35	30	55	No answer 2
	fortis ㄸ	5	35	25	
	aspirated ㅌ	50	35	20	
ㅂ	lenis ㅂ	30	40	35	
	fortis ㅃ	10	0	30	
	aspirated ㅍ	60	60	35	
ㅈ	lenis ㅈ	20	50	70	
	fortis ㅉ	30	15	5	
	aspirated ㅊ	50	35	25	

* Unit: %.

With [Table 6], looking at the perception of lenis sounds, first, for first-year students, the perception of the lenis sound /ㄱ/ is as follows: aspirated /ㅋ/ (50%), lenis /ㄱ/ (20%), fortis /ㄲ/ (20%).

For second graders, the order of perception was lenis /ㄱ/ (45%), followed by the aspirated /ㅋ/(30%), followed by the fortis /ㄲ/ (25%). For 3rd grade students, the order of prevalence was: lenis /ㄱ/ (60%), followed by aspirated /ㅋ/ (30%), followed by fortis/ㄲ/ (10%). For the lenis /ㄱ/, first-year students had the highest rate of cognitive errors, and we can see that the rate of cognitive correctness increases as the duration of study increases. In terms of perception, a higher percentage of students perceived the lenis /ㄱ/ as aspirated /ㅋ/. For the lenis /ㄷ/, the first-year students' perception of the sound was in the following order: aspirated /ㅌ/ (50%) 〉/lenis /ㄷ/(35%) 〉fortis/ㄸ/ (5%); second-year students' perception was in the following order: aspirated /ㅌ/ (35%) 〉 fortis /ㄸ/ (35%) 〉 lenis /ㄷ/ (30%); and third-year students' perception was in the following order: lenis /ㄷ/ (55%) 〉fortis /ㄸ/ (25%) 〉 aspirated /ㅌ/ (20%). For lenis /ㅂ/, first-year students perceived the following order: aspirated /ㅍ/ (60%), lenis /ㅂ/ (30%), fortis /ㅃ/ (10%), and second-year students perceived the following order: aspirated /ㅍ/ (60%), lenis /ㅂ/ (40%), fortis /ㅃ/ (0%). For third graders, the perception of lenis /ㅂ/ (35%) followed by aspirated/ㅍ/ (35%) followed by fortis /ㅃ/(30%). Finally, when looking at the perception of lenis /ㅈ/ by learning period, first-year students perceived it as: aspirated /ㅊ/ (50%), fortis /ㅉ/ (30%), and lenis /ㅈ/ (20%). For second-year students, the perception was lenis/ㅈ/(50%) aspirated/ㅊ/(35%) fortis/ㅉ/(15%), and for third-year students, the perception was lenis/ㅈ/(70%) aspirated/ㅊ/25%) fortis/ㅉ/(5%). As with /ㄱ/, the lowest percentage of correct perceptions of /ㅈ/ was found in first-year students. The results of the lenis sound recognition experiment show that the percentage of correct responses for lenis sounds increases significantly as the learning period increases. The error patterns also show that lenis sounds are more likely to be recognized as aspirated sounds.

5.3.2. Analyzing the Perception of fortis Sounds by Study Period

Table 7. Perception of fortis sounds by learning period

fortis		1st year	2nd year	3rd year	note
ㄲ	lenis ㄱ	27	10	0	No answer 2
	fortis ㄲ	40	50	90	
	aspirated ㅋ	27	40	10	
ㄸ	lenis ㄷ	20	10	10	No answer 1
	fortis ㄸ	60	50	55	
	aspirated ㅌ	10	40	35	
ㅃ	lenis ㅂ	20	20	30	
	fortis ㅃ	10	20	30	
	aspirated ㅍ	60	60	35	
ㅉ	lenis ㅈ	10	15	10	
	fortis ㅉ	70	60	80	
	aspirated ㅊ	20	25	10	

* Unit: %.

As seen in〔Table 7], when we look at the perception of fortis sounds, we see that first-year students perceive the fortis /ㄲ/ sound in the following order: fortis/ㄲ/ (40%), lenis /ㄱ/ (27%), and aspirated /ㅋ/ (27%). For 2nd grade students, the order of perception was: fortis /ㄲ/ (50%), aspirated /ㅋ/ (40%), and lenis /ㄱ/ (10%). For 3rd grade students, the order was: fortis /ㄲ/ (90%), aspirated /ㅋ/ (10%), and lenis /ㄱ/ (0%). When looking at the perception of the fortis /ㄸ/ sound, first-year students perceived the hard /t/ sound in the following order: fortis /ㄸ/ (60%), aspirated/ㅌ/0%), hard /t/ (40%), and hard /d/ (10%). For third graders, the order was fortis /ㄸ/ (55%), aspirated /ㅌ/ (35%), and lenis /ㄷ/ (10%). For the fortis /ㅃ/, first-year students perceived the following order:aspirated /ㅍ/ (60%), lenis /ㅂ/ (20%), fortis /ㅃ/ (10%), while second-year students perceived the following order: aspirated /ㅍ/ (60%), lenis /ㅂ/ (20%), fortis /ㅃ/ (20%). For 3rd grade students, the perception pattern was as follows: aspirated /ㅍ/ (35%) lenis /ㅂ/(30%), followed by aspirated /ㅍ/ (30%). Finally, when looking at the perception of fortis/ㅉ/ by learning period, first-year students perceived fortis/ㅉ/ in the following order: fortis /ㅉ/ (70%), aspirated /ㅊ//20%), and lenis /ㅈ/ (10%). For second-year students, the order of perception was:fortis /ㅉ/(60%), aspirated /ㅊ/ (25%), and lenis /ㅈ/ (15%), and for third-year students, the order of perception was: fortis /ㅉ/ (80%),lenis/ㅈ/ (10%), and aspirated /ㅊ/ (10%). The results of the fortis sound recognition experiment showed that the percentage of correct responses varied depending on the articulatory position of the fortis sound. The affricate fortis /ㅉ/ had the highest recognition rate across all grades, and the Bilabialized fortis /ㄲ/ showed the greatest improvement in correct responses as the learning period increased. These results suggest that, according to Flege's Speech Learning Model (SLM), learners will have less difficulty forming new phonetic categories when the phonemes in L1 and L2 are so different that there is a clear contrast between the familiar phoneme and the new phone.

5.3.3. Analysis of Aspirated Sound Perception by Study Period

Table 8. Perception of aspirated sounds by learning period

aspirated		1st year	2nd year	3rd year	note
ㅋ	lenis ㄱ	10	10	20	
	fortis ㄲ	20	45	20	
	aspirate ㅋ	70	55	60	
ㅌ	lenis ㄷ	20	0	20	No answer 2
	fortis ㄸ	45	40	20	
	aspirated ㅌ	45	60	50	
ㅍ	lenis ㅂ	20	17	15	
	fortis ㅃ	40	17	20	
	aspirated ㅍ	40	67	65	
ㅊ	lenis ㅈ	5	0	20	
	fortis ㅉ	50	40	30	
	aspirated ㅊ	45	60	50	

* Unit: %.

Looking at the perception pattern of aspirated sounds, we can see that for first-year students, the perception of aspirated sound /ㅋ/ is: aspirated /ㅋ/ (70%), fortis/ㄲ/ (20%), and lenis /ㄱ/ (10%). For 2nd grade students, the perception of the aspirated /ㅋ/ was aspirated /ㅋ/ (55%), followed by fortis/ㄲ/ (45%), followed by letis/ㄱ/ (10%). For 3rd graders, the order of perception was: aspirated /ㅋ/ (60%), fortis /ㄲ/(20%), and lenis /ㄱ/ (20%). When looking at the perception of the aspirated /ㅌ/sound, first-year students perceived it aspirated /ㅌ/ (45%), fortis /ㄸ/ (45%), and lenis /ㄷ/ (20%); second-year students perceived it as aspirated /ㅌ/ (60%), fortis /ㄸ/(40%), and lenis /ㄷ/ (0%); and third-year students perceived it as aspirated /ㅌ/ (50%), fortis /ㄸ/ (20%), and lenis/ㄷ/(20%). For /ㅍ/, first-year students perceived it as a aspirated /ㅍ/ (40%), fortis /ㅃ/ (40%), and lenis /ㅂ/ (20%), while second-year students perceived it as a aspirated /ㅍ/ (67%), fortis /ㅃ/ (17%), and lenis /ㅂ/ (17%). For third graders, the perception of the aspirated /ㅍ/ (65%) was followed by fortis/ㅃ/ (20%) and lenis/ㅂ/ (15%). Finally, when we look at the perception of /ㅊ/ by period of study, we find that first-year students perceive it as: fortis /ㅉ/ (50%), aspirated /ㅊ/ (45%), and lenis/ㅈ/ (5%). For second-year students, the order of perception was aspirated /ㅊ/ (60%), fortis /ㅉ/ (40%), and lenis/ㅈ/ (0%), and for third-year students, the order of perception was: aspirated /ㅊ/ (50%), fortis /ㅉ/ (30%), and lenis /ㅈ/ (20%). According to the results of the analysis of the aspirated sounds recognition experiment, the recognition rate of aspirated sound does not improve as the learning period increases. This can be predicted because Korean aspirated sound /ㅋ,ㅌ,ㅍ / are similar to Uzbek /k, t, p/.

6. Results and Discussions

6.1. Native Language Influence

The results of the experiment showed that the lenis sounds /ㄱ,ㄷ,ㅂ,ㅈ/were recognized at a low rate, while the aspirated sounds /ㅋ,ㅌ,ㅍ,ㅊ/ were recognized at a very high rate. This can be interpreted as a result of the difficulty in distinguishing between the two sounds, lenis sounds /ㄱ,ㄷ,ㅂ,ㅈ and aspirated sounds /ㅋ,ㅌ,ㅍ,ㅊ/, because they correspond well to the voiceless plosives /k, t, p, ch/ in Uzbek. This assimilation of two Korean sounds into a single category of the learner's native language can be considered the most difficult type of single-category assimilation (SC) in PAM. As a result, we can see that learners have difficulty distinguishing between lenis sounds and aspirated sounds . This is consistent with the predictions of the PAM. In the case of /ㅋ,ㅌ,ㅍ,ㅊ/, they perceive it as /ㅋ,ㅌ,ㅍ,ㅊ/ most often, and in terms of errors, they perceive it as /ㄲ,ㄸ,ㅃ,ㅉ/ rather than /ㄱ,ㄷ,ㅂ,ㅈ/. In addition, they perceive it as /ㄲ,ㄸ,ㅃ,ㅉ/ with the highest rate of correct recognition. Flege defined 'new phone' in SLM as a sound that is difficult to find a corresponding sound in the native language and has a distinct acoustic difference. It was predicted that 'new phones' would form a new phonetic category and be the easiest to acquire because they are completely different from the sounds in the native language and there is no experience with them. Therefore, the high recognition rate for fortis /ㄲ,ㄸ,ㅃ,ㅉ/ is consistent with SLM's prediction.

6.2. The Influence of Learning Duration

Previous studies on the linguistic experience factor (Flege, Bohn, and Jang (1997), Best and Tyler (2007)) have argued that the longer the duration of residence in an L2 environment, the more the development of new phones that are different from the learner's native language, but the less the development of phones that are similar to the native language [21], [22], [23]. Kang et al. found that both experienced speakers who had lived in Korea and non-experienced speakers who had never lived in Korea or had lived in Korea for one month or less showed an increase with increasing duration of experience with Korean. As shown in the〈Figure 2〉, when examining the differences in recognition by phonetic type, it was found that the overall recognition rate of lenis /ㄱ,ㄷ,ㅂ,ㅈ/ and fortis /ㄲ,ㄸ,ㅃ,ㅉ/ showed an increase, while aspirated /ㅋ,ㅌ,ㅍ,ㅊ/ did not show an increase but rather showed difficulty in recognition [1].

In this experiment, we investigated how the perception of plosives and affricates changes as the learning period increases for Korean learners in Uzbekistan as a foreign language. The results showed that the recognition rate of lenis sounds /ㄱ,ㄷ,ㅂ,ㅈ/ and fortis sounds /ㄲ,ㄸ,ㅃ,ㅉ/ increased significantly as the learning period increased. In terms of error patterns, lenis /ㄱ,ㄷ,ㅂ,ㅈ/ were more likely to be recognized as aspirated /ㅋ,ㅌ,ㅍ,ㅊ/. The perception of fortis sounds /ㄲ, ㄸ, ㅃ, ㅉ/ improved the most over the study period. The aspirated /ㅋ,ㅌ,ㅍ,ㅊ/ did not improve with increasing study duration. In fact, third-year learners had the lowest recognition rates. These results suggest that the L2 experience factor is very similar for speech perception as a function of duration of residence in the L2 environment and speech perception as a function of duration of learning in the native language environment.

Conclusion

The present study investigated Uzbek learners of Korean's perception of word-initial plosives and affricates to find out how they differ according to learners' first language and duration of learning. Ultimately, we hope to lay the foundation for effective pronunciation instruction for learners of Korean as a foreign language outside the target country. The following conclusions were drawn as a result of the experiment'

First, Uzbek learners showed the lowest recognition rate for lenis sounds and the highest recognition rate for fortis sounds among Korean three-way opposition such as, lenis, fortis, and aspirated sounds. When looking at the perception patterns, lenis tones were more often perceived as aspirated tones, and aspirated tones were more often perceived as fortis tones than lenis tones. This is because the lenis /ㄱ,ㄷ,ㅂ/ and aspirated /ㅋ,ㅌ,ㅍ/ of the Korean plosive series are assimilated into the category of Uzbek voiceless aspirated sounds /k, t, p/ as a single-category type classified by Best's PAM. The fortis sounds /ㄲ,ㄸ,ㅃ,ㅉ/, which have the highest recognition rate, are assimilated into the category of Uzbek voiced non-aspirated sounds /g, d, b, j/. which means that they form a new phonetic category in Flege's SLM that is not present in the native language. On the other hand, the recognition rate for the aspirated /ㅋ,ㅌ,ㅍ,ㅊ/ was high. This can be explained by the fact that the Korean /ㅋ,ㅌ,ㅍ/ have a high percentage of correct responses because there are voiceless aspirated sounds /k, t, p/ with the same phonetic value in Uzbek.

Second, when we examined the change in percentage of perception over the learning period, we found that, although the overall rate improved, the rate of recognition of lenis /ㄱ,ㄷ,ㅂ,ㅈ/ and fortis

/ㄲ,ㄸ,ㅃ,ㅉ/ improved by voice type, while the rate of recognition of aspirated /ㅋ,ㅌ,ㅍ,ㅊ/ actually decreased as the learning period increased. This is consistent with Flege and Hillenbrand (1984) and Bohn and Flege (1992), who found that the accuracy of pronunciation of non-L1 sounds improves with increasing duration of residence in the target language environment, but the accuracy of pronunciation of L1-like sounds is independent of duration of residence.

The results of this study indicate that when teaching Uzbek learners to pronounce plosives and affricates in Korean, it is necessary to explain the difference in pitch rather than overemphasizing the distinction among three-way opposition sounds. In addition, for Uzbek learners who have a voiced/voiceless binary system, the lenis sound of the initial sound of a word may cause cognitive confusion even after a long period of learning, so careful instruction is needed.

The significance of this study is that it was conducted on learners of Korean in Uzbekistan, an area that has not been widely studied. However, it is disappointing that it only investigated the cognitive aspects of learners through a cognitive experiment. Future studies should also examine the correlation between perception and production of Korean speech.

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Appendix

인지 실험지

이름:	나이:
남자/여자	1년 2년 3년

듣고 맞는 말에 O 하십시오.

1.	① 기	② 키	③ 끼
2.	① 커	② 꺼	③ 거
3.	① 까	② 가	③ 카
4.	① 꼬	② 코	③ 고
5.	① 그	② 끄	③ 크
6.	① 디	② 티	③ 띠
7.	① 떠	② 더	③ 터
8.	① 타	② 따	③ 다
9.	① 드	② 뜨	③ 트
10.	① 또	② 도	③ 토
11.	① 바	② 파	③ 빠
12.	① 쁘	② 브	③ 프
13.	① 퍼	② 버	③ 뻐
14.	① 피	② 비	③ 삐
15.	① 뽀	② 보	③ 포
16.	① 조	② 쪼	③ 초
17.	① 쩌	② 처	③ 저
18.	① 자	② 차	③ 짜
19.	① 찌	② 치	③ 지
20.	① 즈	② 쯔	③ 츠