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Confusion in the Perception of English Labial Consonants by Korean Learners

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요약

영어 마찰음을 발음하기 어려운 점은 잘 알려졌는데, 한국 대학생들이 마찰음을 포함하는 영어 순자음을 인지하는데도 마찬가지로 어려움을 느끼는지 알아보기 위하여 40명의 한국 대학생들을 대상으로 영어 순자음이 들어간 임시어를 4가지 다른 운율적 위치(초성, 종성, 강세 앞 모음사이, 강세 뒤 모음사이)에서 인지하는 테스트를 실행하였다. 실험 참가자들은 초성이나 강세 앞 모음사이처럼 강한 위치의 자음을 종성이나 강세 뒤 모음사이의 약한 위치보다 더 정확하게 판별하는 인지패턴을 보여주었다. 한국 학생들의 인지의 어려움은 모든 운율 위치에서 영어 목표자음의 조음방법 혼동 때문에 대부분 발생하였다. 그밖에, 조음장소와 유무성의 혼동도 일어났는데, 조음장소의 혼동은 모든 운율 위치에서 주로 [f]의 음향적 속성 때문에 일어났으며 유무성의 혼동은 운율 위치의 영향 때문에 발생하였다. 이러한 조음방법, 조음장소, 유무성의 혼동은 목표자음의 음성적 속성 그리고/또는 피실험자의 모국어 속성으로 설명되었다.

■ 중심어 : | 영어 순자음 | 인지 테스트 | 음향적 단서 | 조음방법 혼동 | 조음장소 혼동 | 유,무성 혼동 | 운율적 위치 | 모국어 경험 |

Abstract

Based on the observation that Korean speakers of English have difficulties in producing English fricatives, a perception experiment was designed to investigate whether Korean speakers also have difficulties perceiving English labial consonants including fricatives. Forty Korean college students were asked to perform a multiple-choice identification test. The consonant perception test consisted of nonce words which contained English labial consonants [p, b, f, v] in 4 different prosodic locations: initial onset position, intervocalic position before stress, intervocalic position after stress, and final coda position. The general perception pattern was that the mean accuracy rates were higher in strong position like CV and VCVV than in weak position like VC and VVCV. The difficulties in perceiving the English targets resulted mainly from bidirectional manner confusion between stop and fricative across all prosodic locations. The other types of misidentification were due to place confusion as well as voicing confusion. Place confusion was generated mostly by the target [f] in all prosodic position due to acoustic properties. Voicing confusion was heavily influenced by prosodic position. The misperception of the participants was accounted for by phonetic properties and/or the participants' native language properties.

■ keyword : | English Labial Consonants | Perception Test | Acoustic cues | Manner Confusion | Place Confusion | Voicing Confusion | Prosodic Position | Native Language Experience |

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I. Introduction

It is well-known that Korean speakers of English have difficulties in producing English fricatives such as [f] and [θ], which are not present in the inventory of the Korean language. In particular, the English labial fricative [f] is notoriously misproduced as stop [p]. There are four labial obstruent consonants in English: Two stops [p]/[b] and two fricatives [f]/[v]. Unlike in English, the Korean language has no labial fricatives but only labial stops: [p]/[p^h]/[p']/[b].

The distribution of the Korean labial stops, however, are restricted in a language-specific way. The Korean aspirated and constricted [p^h]/[p'] can occur in either initial onset position (CV) or intervocalic position (VCV). By contrast, [p] can occur only in initial onset position and [p] becomes the voiced allophone [b] in intervocalic position, undergoing intervocalic voicing. Moreover, none of [p]/[p^h]/[p']/[b] can occur in final coda position (VC) because of Korean coda neutralization whereby only unreleased [p̚] emerges in coda. Consequently, more pronunciation errors are expected to be incurred when Korean people produce the English labial consonants because labial consonants are so different in Korean and English. Further, it is expected that Korean people have different degrees of difficulties differed by position such as VC and VCV. Based on this observation, the question raised in this paper is whether Korean people also have difficulties in perceiving the English labial consonants and if so, whether the difficulties are different depending on prosodic position.

The perception of English consonants by foreign speakers was investigated in previous studies such as Cho (2006) and Lee and Cho (2006). However, the focus of the previous studies only concerned how accurate the perception was. The content of inaccurate perception was ignored. Specifically, Lee & Cho (2006) reported that the correct percentage of the English anterior obstruent perception by Korean speakers was high, 72.2% in intervocalic position before a stressed vowel and 68.76% in initial onset position. By contrast, the correct percentage of the same targets was low, only 53.36% in intervocalic position after a stress and 41% in final coda. Although Lee & Cho insightfully demonstrated Korean speakers' perception of English targets was subject to positional effects, they do not consider the extent and factor which caused the misperception. Thus, in this paper the substance of perception difficulties are explored in detail so as to reveal how and why Korean speakers confuse the English labial targets.

II. Methods

1. Experiment

In order to examine perceptual difficulties posed to Korean learners of English, 40 college student were recruited in the metropolitan area of Seoul to conduct a multiple-choice perception test. The participants consisted of 12 male students and 28 female students and their English proficiency was considered as about the same because they were drawn from the same department. Also, none of them have special English training.

2. Stimulus Construction

The target English labial obstruents [p], [b], [f], and [v] were combined with the neutral low vowel [ɑ]. The combination of the target consonants and the neutral vowel were generated in 4 different prosodic locations: Initial onset (CV), final coda (VC), intervocalic position before stress (VCVV), and intervocalic position after stress (VVCV). Intervocalic

position was further divided into two different locations depending on stress: before stress and after stress.

(1) Stimulus consonants by feature and prosodic position

Place	Manner	Voicing	CV	VC	VCVV	VVCV
labial	stops	voiceless	pá	áp	apá	ápa
		voiced	bá	áb	abá	ába
	fricatives	voiceless	fá	áf	afá	áfa
		voiced	vá	áv	avá	ává

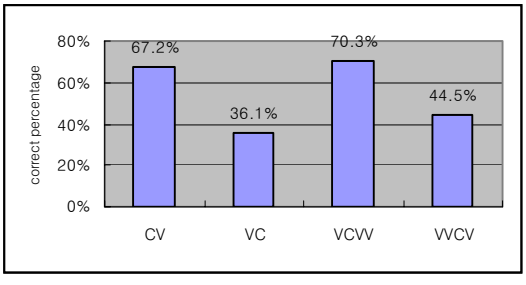
Four native speakers of English (two female and two male) recorded the stimulus consonants. The randomized stimuli were auditorily presented to the Korean participants so that the participants chose the target stimuli they heard in a paper-and pencil type multiple-choice test. The result of the identification test was collected and scored.

III. Results and Discussions

1. Overall results

As observed in Cho (2006) and Lee & Cho (2006), the overall correct identification rates of English labial consonants were higher in the prosodic position of CV and VCVV than VC and VVCV.

(2) Overall correct identification rate by position



As in (2), the participants showed 67.2% of accuracy in perceiving the labial consonants in CV position and 70.3% in VCVV position. In contrast, the listeners performed poorly in identifying the target consonants in VC and VVCV position (36.1% and 44.5%, respectively).

The high mean accuracy rates for initial onset CV and medial onset VCVV locations compared to the other locations such as VC and VVCV is not uncommon given the positional markedness in which segments in initial position (i.e., onset) are easier to acquire than those in final position (i.e., coda) (Carlisle 1994, Eckman & Iverson 1994, Bhatt & Bhatt 1997). This is because onset position is traditionally considered as strong and prominent by many scholars (Anderson 1987 among others). Thus, it would be rare to witness processes such as deletion and neutralization in prominent onset position. On the other hand, coda position is relatively weak compared to onset position so that it is more likely to be subjected to phonological processes like deletion, coda neutralization, and coda simplification. Further, only a limited set of consonants can occur in coda position. Then, it may be deduced that acoustic (i.e., perceptual) cues are more salient in strong onset position than in weak coda position. That is, more phonetic and acoustic cues are available in strong position whereas less acoustic cues are available in weak position. As a result, it would be more difficult for listeners to identify consonants in coda position than in onset position. Notice that consonants in intervocalic position after stress (VVCV) tend to be realized as coda of the preceding syllable due to the stress of the preceding syllable. By contrast, consonants in intervocalic position before stress (VCVV) is realized as onset of the following syllable due to the onset maximization principle (Selkirk 1982).

Word-medial intervocalic position is known as the

location to witness weakening processes such as voicing and flapping. Nonetheless, intervocalic position before stress exhibited high mean accuracy since the consonant in VCVV is syllabified as onset. Although intervocalic position is articulatorily weak, it is acoustically prominent. Consonant articulation itself have no distinguishing feature and the quality of a consonant is conveyed by adjacent vowels (Ladefoged 2006). Then, it can be inferred that intervocalic position conveys more information of the consonant because the perceptual information is encoded in flanking vowels (i.e., VC and CV transitions) whereas the information of consonants in CV and VC is encoded only in one adjacent vowel. Beginning in the next section, the extend to which Korean learners of English differentially identify English labial consonants in 4 different prosodic locations as well as the degree of confusion rates are reported.

2. Confusion in the Perception of [p]

As for the identification of the voiceless labial stop [p], the proportions of correct [p] identification were 89.4% in CV position and 75.6% in VCVV position. In contrast, the proportions of correct identification were steeply decreased in VC position and VVCV position, only amounting to 21.9% and 33.1%, respectively.

(3) Identification of English /p/

CV	VC	VCVV	VVCV
[p] 89.4% [f] 6.9%	[p] 21.9% [b] 16.9% [f] 10% [h] 7.5% [t] 7.5%	[p] 75.6% [f] 14.4%	[p] 33.1% [f] 26.9% [b] 13.8%

In initial onset CV position only a few participants confused the target voiceless stop [p] with the voiceless labiodental fricative [f] (6.9%), while most listeners correctly identified the target consonant. The perceptual confusion of the target [p] with [f] is rather surprising given that Korean speakers of English frequently mispronounce English [f] as [p] (Lee and Cho 2002, among others). The replacement of [f] by [p] is conceivable because the Korean inventory does not have the labiodental fricative [f] and the most similar consonant to [f] is [p] in the Korean language, sharing labial gestures. However, the substitution of the target [p] with [f] is attributable to overgeneralization whereby the listeners might extend the replacement rule of the target [f] with [p] beyond its range of applicability in the standard use. Although the listeners had a very small bias toward identifying the target stop as fricative, the listeners' voicing identification was quite good in onset position in the case of the voiceless stop [p].

In final coda position the target [p] was almost imperceptible so that the participants had extreme difficulties identifying the target consonant because they confused [p] with [b], [f], [h], [t] and so on. The diverse identification of coda [p] resulted from perceptual confusions is not surprising because phonetic and acoustic cues are less available in coda position, compared to onset position. Moreover, only a restricted range of consonants (i.e., unreleased stops, nasals, lateral) occur in coda position in Korean due to coda neutralization so that Korean speakers tend to be more confused in perceiving various consonants in coda. The confusion of [p] with the voiced counterpart [b] is understandable in that Korean does not have voice distinction in the phonemic level. Consequently, Korean listeners may have difficulties in distinguishing voice feature between [p] and [b]. Further, the target [p] in coda has a smaller degree of air releaseness relative to that in onset. Thus, Korean

listeners confused [p] with [b] because [b] also has a smaller degree of air releaseness. The confusion of [p] with [f] was already witnessed in onset position. The confusion of [p] with the fricative [h] can be accounted for by the phonetic fact that the target [p] had a small degree of air releaseness in coda position so that the listeners misperceived the target as fricative since fricatives are inherently released but air releaseness of fricatives is not as strong as that of stops. The confusion of [p] with [t] can be explained as a place bias toward identifying the voiceless bilabial stop as the voiceless alveolar stop.

In intervocalic position before stress (VCVV) not many participants confused in identifying the target [p] because it was located in onset position as well as between flanking vowels, both of which are perceptually salient. Thus, only 14.4% of responses confused [p] with [f] and the confusion rate of [p] with [f] was a little bit higher than the locations like CV and VC, though.

In intervocalic position after stress (VVCV) the target [p] identification was highly inaccurate. This is expected given that phonetic cues are less prominent in this position. The participants confused the target [p] with [f], as witnessed in other locations. Additionally, the target was incorrectly perceived as [b], which was also observed in VC position.

3. Confusion in the Perception of [f]

The identification of the voiceless labiodental fricative [f] did not divert from the general pattern in that the accuracy rate of [f] identification was higher in prosodic position such as CV and VCVV than VC and VVCV. Specifically, the participants showed 75.6% of accuracy in both CV and VCVV whereas they showed 65.6% of accuracy in VC and 41.9% in VVCV.

(4) Identification of English [f]

CV	VC	VCVV	VVCV
[f] 75.6%	[f] 65.6%	[f] 75.6%	[f] 41.9%
[b] 8.1%	[h] 11.3%	[θ] 9.4%	[p] 13.8%
	[θ] 8.1%	[p] 6.3%	[v] 9.4%
			[b] 8.8%
			[θ] 8.1%

In initial onset position the listeners were quite good at correctly identifying the target [f]. Yet, 8.1% of responses were misperceived the target as [b]. The replacement of [f] with [b] would be interpreted as the confusion of the manner feature as well as the voice feature. The confusion of the target [f] with the labial stop (either [p] or [b]) is expected because Korean speakers of English frequently substitute [f] with [p] due to the inventory difference between English and Korean. Then, the question of why the listeners misperceived the target as the voiced stop [b] could be raised. The air releaseness of the target [f] is smaller than other sibilant fricatives like [s]. The small degree of air releaseness of the target could be connected as voiced, not voiceless because English voiced stops have shorter VOTs (Voice Onset Time) than voiceless stops. VOT begins from the burst of noise which indicates air releaseness of stops to the start of vowel wave forms and long VOTs yields aspiration. Consequently, the target [f] may be misperceived as the voiced [b], not the voiceless [p], because both [f] and [b] involve less degree of air releaseness having short VOTs, although Korean speakers frequently produce [f] as Korean aspirated [p^h].

As for the confusability of [f] in final coda position, [f] identification was reasonably accurate relative to the identification of other target consonants in coda, although it was located in weak position. However, the target in coda was still confusable with other

fricatives such as [h] and [θ]. The confusion of [f] with either [h] or [θ] reflects the phonetic fact that fricatives share the property of air releaseness. That is, the participants were accurate in identifying the manner feature of continuancy as well as voicing feature while their place identification was far less accurate. In particular, the confusion of [f] with [θ] has been noted by many scholars. For example, Strevens (1960), based on the acoustic study of fricatives, notices that [f] and [θ] are acoustically similar being low in intensity so that they form an acoustic natural class. Moreover, he notes that place cues on [f] and [θ] are quite similar since the location of spectral peaks in [f] and [θ] are not distinct each other. Ladefoged (2006) also made a similar observation that the spectral differences between [f] and [θ] are so small that they are often confused in noisy circumstances and they are even considered as one sound in some accents of English like London Cockney. These perceptual similarity facts result in the confusability between [f] and [θ].

In VCVV position the target [f] was identified fairly accurately, but it was occasionally confused with [θ] and [p]. The place confusion between [f] and [θ] can be explained by the acoustic ambiguity found in the spectrogram patterns of [f] and [θ], as mentioned above. The manner confusion of [f] with [p] was understandable given the observation that Korean speakers frequently substitute English [f] with [p] in production. Similarly, in perception the participants showed a small degree of manner bias toward identifying the target fricative as stop. Yet, the participants did not show voicing confusion in this strong position.

In VVCV position the identification accuracy of the target [f] was worst across prosodic position, which is expected in weak position. The participants confused the target with various consonants which differ from manner and voice as well as place. The target was confusable with [p], [v], [b], and [θ]. The confusion of [f] with [p], [b], and [θ] was already mentioned in other prosodic locations. The confusion of voiceless [f] with voiced [v] is worth mentioning. The target was located between flanking vowels as well as in weak coda position. In Korean voicing contrast occurs only in intervocalic position. Thus, Korean plain stops become voiced counterpart allophones in intervocalic position, undergoing intervocalic voicing. As a result, Korean listeners might misidentify voiceless consonants in intervocalic position as voiced. Moreover, intervocalic position is a favorite location for voiced segments.

4. Confusion in the Perception of [b]

The perception pattern of the voiced stop [b] was rather different from the general pattern in that the identification accuracy in weak intervocalic position after stress was unexpectedly high (70.6%). It was even higher than the strong initial onset position (51.9%), although it was lower than intervocalic position before stress (73.8%). The accuracy rate in the final coda position was worst (27.5%), which conforms to the general pattern.

(5) Identification of [b]

CV	VC	VCVV	VVCV
[b] 51.9%	[b] 27.5%	[b] 73.8%	[b] 70.6%
[p] 13.8%	[v] 14.4%	[v] 16.3%	[v] 14.4%
[f] 13.8%	[h] 7.5%		
[v] 7.5%	[w] 6.9%		

With respect to the confusability of the voiced target [b] in initial onset position, the accuracy in identifying the target was not high enough, compared to other voiceless targets. The target was confused

with the voiceless counterpart [p]. The confusion of [b] with [p] was not surprising given the initial devoicing effect. According to Ladefoged (2006), the amount of voicing for the voiced stops depends on the environment which they occur in. In initial position most English speakers have no voicing during the closure of voiced stops so that the listeners may misperceive the voiced stops as voiceless. The confusion of [b] with the voiceless fricative [f] can be accounted for along the same line of [p] confusion with [f] in section 2. Further, the participants misidentified the target as voiceless because of the initial devoicing effect mentioned. Some responses confused the target with the voiced fricative [v]. The confusion of the target with [v] can be regarded as manner confusion like the confusion of the target with [f], but in this case the participants' voicing identification was good. In initial onset position there was a bias toward identifying the target as fricative as well as voiceless. However, there was no misidentification of place.

In final coda position the target [b] was largely identified incorrectly to the extent that the participants misperceived the target as [v], [h], [w] and so on. The confusion of the target with the voiced fricative [v] was witnessed in initial onset position, too. The misperception of the target as [h] might due to a small degree of air releaseness by the target in coda, like the case of the target [p]. Stops in coda tend to have a small degree of air releaseness, although some native speakers tend not to release air. The participants seemed to hear this small degree of air releaseness and to interpret it as the fricative [h] because fricatives are inherently released. The confusion of the target with the labial semi-vowel [w] was interesting in that the participants interpreted the place and voiced features of the target as [w], which also contains the labial place feature and the voiced feature.

The confusion pattern in both VCVV and VVCV position was rather simple and similar. A small portion of the target voiced stop [b] was confused with the voiced fricative [v]. The confusion of [b] with [v] indicated that the participants did not confuse the voicing feature of the target, but they confused the manner feature of the target. Good voicing identification seemed to be due to the sympathetic intervocalic environment in which voicing was enhanced. The manner confusion of the target stop with fricative was mentioned above.

5. Confusion in the Perception of [v]

The identification of the voiced labiodental fricative [v] conformed to the general pattern, although the accuracy rate was the lowest among the four targets. In strong initial onset and intervocalic position before stress, the correct proportions of the target identification accounted for 51.9% and 56.3% of the responses, respectively. In weak final coda and intervocalic position after stress, the correct proportions were 29.4% and 32.5%, respectively.

(6) Identification of [v]

CV	VC	VCVV	VVCV
[v] 51.9%	[v] 29.4%	[v] 56.3%	[v] 32.5%
[ə] 15%	[f] 20%	[b] 28.8%	[b] 50%
[b] 14.4%	[b] 12.5%		
[d] 6.9%	[h] 10%		
	[w] 10%		

As for the confusability of the target [v] in initial onset position, the target was sometimes confused with the voiced interdental fricative [ð]. The confusion of [v] with [ð] could be explained by the similar acoustic properties between [v] and [ð], along

the same line of the place confusion of [f] with [θ] mentioned above. The participants also confused the target with the voiced bilabial stop [b] and the voiced alveolar stop [d]. The confusion of the fricative [v] with [b] could be due to a manner bias toward identifying the target fricative as stop. The confusion of [v] with [d] was place and manner confusion toward identifying the target labiodental fricative as alveolar stop.

In final coda position substantial numbers of responses were biased toward identifying the voiced target as voiceless. The incorrect identification of the target as the voiceless counterpart [f] seemed to be influenced by the final devoicing effect. Generally, voiced consonants in final coda position are voiced throughout the articulation only if they are followed by another voiced sound. For instance, in a phrase like "prove it", the [v] is fully voiced because of the following vowel. Otherwise, the [v] is not fully voiced (Ladefoged 2006). The manner confusion of [v] with [b] was also witnessed in initial onset position. The confusion of the target with [h] was also observed in initial onset. The misperception of the target as [w] could be accounted for along the similar line of the [b] confusion with [w] in the previous section.

The confusion pattern of the target [v] in intervocalic position was rather similar to the confusion pattern of [b], although the accuracy rate in identifying [v] was lower than [b]. In intervocalic position before stress, some portions of the target voiced fricative [v] was confused with the voiced stop [b], indicating manner confusion. In intervocalic position after stress the participants had great difficulties in identifying the target [v] so that the accuracy rate only amounted to 32.5%. About fifty percent of the responses misidentified the target as the voiced stop [b].

IV. Conclusion and Summary

The perceptibility of the targets was enhanced in strong prosodic locations such as initial onset and medial onset because more acoustic cues are available in the strong position. Conversely, acoustic cues in weak position such as final coda and intervocalic position after stress are less salient so that it is more likely to result in imperceptibility of the targets. Consequently, the participants responded more accurately to the targets in strong position than to the targets in weak position. In particular, the target in final coda always elicited more errors than any other prosodic locations, resulting in chaotic misperception. Although intervocalic position after stress was weak thus causing perceptual confusion, the identification of the voiced targets (especially for the voiced feature) was fairly accurate in this position. This indicates that the targets in intervocalic position, regardless of stress, are likely to be perceived as voiced.

The major source of misperception was due to bidirectional manner confusion between stop and fricative across all prosodic locations. The participants confused the fricative targets with stop, and conversely confused the stop targets with fricative. Given the common observation that Korean speakers of English frequently misproduce English [f] as [p], the manner confusion of stop with fricative is rather unexpected and characteristic of perception. The other types of misidentification resulted from place and voicing confusion. Place confusion was generated mainly by the target [f] in all prosodic position due to acoustic similarities between [f] and [θ]. Similar place confusion was also emerged between [v] and [ð]. In addition, there were place confusion of the target [p] with [t] and [h] in final coda position. Likewise, the confusion of the target [v] with [h] in final coda and with [d] in initial onset

was witnessed. Finally, voicing confusion was heavily influenced by prosodic position given the initial devoicing effect in initial onset and final devoicing effect in final coda. Further, intervocalic position tended to help the targets be perceived as voiced. The misperception of the participants was accounted for mainly by acoustic properties and/or the participants' native language experience.

From the findings of the current study, the following can be suggested for an effective English listening instruction. First, with respect to the manner confusion, more focus should be on the manner distinction between stop and fricative. Secondly, more emphasis should be placed on the English sounds that do not exist in Korean, like [f]. Finally, positional factors should be integrated into instruction, such that segments in weak position should call for particular attention. The current study, however, has some limitations. As the number of the participants was small and female-dominant, it might be hard to generalize the results to the general Korean population of students. Finally, relevant contents regarding the perception of English sounds should be developed so as to be used by English teachers in class.

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