L1 Transfer in L2 Variation: The case of "disappearing /w/" in the English of Korean learners

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Abstract

This paper examines the tendency for Korean speakers of English to delete /w/ in their L2 learning as in words like 'question' and 'quiz'. The results show that the /w/ deletion is due to L1 transfer. Two experiments were carried out: /w/ deletion in Korean and in English. The first experiment consisted of 6 native speakers of Korean and the second 10 Korean speakers of English. Two set of reading passages, both in Korean and English, that consist of a set of /w/-including words were provided. The first group of subjects was asked to read the Korean passage and the second the English passage, respectively. In each study, their reading were recorded and analyzed in terms of the conditioning factors of /w/ deletion.

The first study shows that the phenomenon of /w/ deletion in Korean occurs only when the labiovelar glide functions as a part of nucleus of a syllable, not the onset. The deletion will be shown to be conditioned by three additional factors:

1. Place of articulation of the preceding consonant: /w/ is deleted more often either after [+labial] consonants (Kang 1996) or before [+back] consonants (Silva 1991)
2. Quality of the following vowel: /w/ is more likely to be deleted before [-back] vowels
3. Syllable position in the word: non-initial syllable position in the word facilitates /w/ deletion in the speech of Koreans.

While earlier studies (Silva 1991; Kang 1996) mainly focused on the first factor, this paper argues that, in light of the new data collected, the second and third factors are more influential. The second study reveals that Korean learners delete /w/ in their English following the /w/-deletion rules of Korean. When the labiovelar glide /w/ is perceived as the onset of a syllable, it is rarely dropped. The Korean learners of English deleted /w/ frequently when they perceived /w/ as part of the nucleus. This frequent deletion of /w/ is controlled by the two factors (2 and 3 above) which I claim to be major in /w/ deletion in Korean.

1 Introduction

Korean learners of English tend to delete or weaken the labiovelar glide /w/ in English words such as quick and language, even though Korean allows CGV(C) syllable structure (Ahn 1998: 75 and others, e.g. Silva 1991). The noticeable fact is that the labiovelar glide is deleted often in Korean as well (Silva 1991; Kang 1996). However, whether this variable pronunciation of /w/ in English by Korean speakers can be attributed to L1 transfer has not been discussed in the literature. Since the /w/ deletion in English words is not just an individual variant but a commonly observable variation among many Korean learners of English, this paper is to explore how the phonetic variation of /w/ in Korean plays a role in L2 learning based on the data collected.

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In order to investigate the /w/ variation phenomenon in L2 as due to L1 transfer, it is necessary to find out first what kinds of factors determine /w/ deletion in Korean. Therefore, I will discuss /w/ deletion in Korean first. After the Korean study, I will investigate /w/ variation in English by 10 Korean learners in terms of the rules drawn from the Korean study.

2 /w/ deletion in Korean

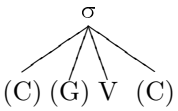
In Korean the labiovelar glide /w/ is often deleted in casual speech. I will explore the contexts in which the labiovelar glide is more often deleted and will formulate some general rules on /w/-deletion based on data collected from six native Korean speakers. While earlier studies considered the role of a preceding consonant as a major factor, I will argue that the quality of the following vowel and /w/'s position in a word—whether it occurs in an initial or non-initial syllable—are the major factors. I will examine this phonological variation in terms of three factors: place of articulation of the preceding consonant, the choice of the following vowel, and syllable position.

2.1 Background

2.1.1 Korean phonology

Before reviewing the studies by Kang (1996) and Silva (1991), I will introduce some basic concepts of Korean phonology as they pertain to the discussion that follows. Korean syllable structure can be formalized as in Figure 1. The minimal syllable is V, while the maximum is CGVC (Ahn 1998: 75, Silva 1991: 154, Kang 1996: 57, Bae 1997: 79).

Figure 1: Korean syllable structure



As for the Korean consonant system, there are 19 segments located at five places of articulation: bilabial, alveolar, palatal, velar and glottal. The labiovelar glide /w/ can occur after consonants of all five places of articulation. According to standard sources (e.g. Lee 2002: 344), I assume the Korean vowel system to include 8 or 10 monophthongs as shown in Table 1. The Korean diphthong system, based on the monophthongs from Table 1, is illustrated in Table 2.

Table 1: Korean monophthongs (Lee, 2002:344)

	front		back	
	unrounded	rounded	unrounded	rounded
high	i	(ü)	ɨ	u
mid	e	(ö)	ə	o
low	ɛ		a	

A further interesting point about Korean phonology is the status of glides in syllable structure. Glides in Korean have traditionally been considered as part of the nucleus, because of the influence of native orthography and because that Korean does not allow onset consonant clusters

Table 2: Korean diphthongs (Lee 2002:344, Ahn 1998: 66)

	front		back	
	[−bk][−rnd]	[−bk][+rnd]	[+bk][−rnd]	[+bk][+rnd]
[+high]	*yi wi	*yu *wü	yɨ wɨ	yu *wu
[−high, −low]	ye we	*yö *wö	yə wə	yo *wo
[+low]	yɛ wɛ		ya wa	

in a syllable. However, I assume here that the labiovelar glide /w/ moves to the onset position in phonetic representation when there is no onset in the syllable (Ahn 1998: 80 and Cheon 2002: 626). That is, in a syllable that starts with a glide without a preceding consonant the glide moves to the place of onset due to the universal preference for CV structure in syllabification. Therefore, the glide in the onset position is deleted less frequently than is a glide in the nucleus after a consonant. Based on this assumption, this paper will discuss /w/ deletion mainly in CGV(C) syllables.

2.1.2 Earlier studies on /w/ deletion

Silva (1991) and Kang (1996) studied Korean /w/ deletion. While both studies explained that /w/ deletion was conditioned by various factors such as social, linguistic and stylistic, Silva (1991) pointed out that the place of articulation of the preceding consonant was the primary factor: labiovelar glide deletion is more favored when it comes after non-velar consonants. That is, he explained, when the labiovelar glide shares the feature [+back] with an adjacent velar segment, it provides a structural cohesiveness that inhibits the application of the deletion rule. In addition, he suggested many other factors, such as speech style and the [+back] feature of the following vowel, which he considered to be minor. On the other hand, Kang (1996) explains the fact that /w/ was more likely to be deleted after [+labial] consonants by appealing to the Obligatory Contour Principle (OCP)[1]. In particular, he suggested that the acoustic ambiguity of the 'bilabial consonant + /w/+ V' sequence prompts the learners to attribute the acoustic cue of /w/ to the preceding bilabial consonant, and to interpret the above sequence as the same as 'bilabial + V'.

The deletion of the labiovelar glide will be discussed in terms of three factors: place of articulation of the preceding consonant, following vowel, and syllable position. As for the place of articulation of the preceding consonant, I will examine which study can be supported: Does Silva's study or Kang's explain /w/-deletion better? Second, guided by Silva's idea, I will determine which following vowels facilitate /w/-deletion. Finally, even though Kang (1996) did not consider syllable position as a major factor, I will investigate whether it plays a major role given the fact that the initial syllable of a word has more prominent prosody than does a non-initial syllable.

2.2 Method

The data for this study are from interviews conducted in Spring 2003. The subjects were six native Korean speakers who were studying at the University of Wisconsin–Milwaukee as graduate or undergraduate students at the time of data collection. Their ages vary from 20 to 35; only

[1]The tendency for constituent siblings not to have similar places of articulation is formalized as an instance of the 'Obligatory Contour Principle' (Roca and Johnson 1999: 273).

two subjects are female. All the subjects came from the Seoul and Kyunggi areas, which do not have strong dialectal differences.

The subjects were asked to read a text casually which included about 50 words, with the labiovelar glide /w/, pronounced in standard Korean. To distract the subjects' attention from the pronunciation, I put each word in a sentence and then put the sentences in random order, making one long paragraph, even though the sentences did not make a single story. While the subjects were reading the passage in a quiet place, I recorded them.

After recording the subjects, I made impressionistic judgments regarding the presence or absence of the glide /w/. Each word by each subject was judged as "/w/-present" or "/w/-deleted," "ambiguous," and then I calculated a mean percentage of "/w/-present" for all the subjects for each word as shown in Figure 2. Figuring the percentages, I excluded the number of "ambiguous" cases out of the total number (see Table 7, page 62).

Figure 2: Calculating the mean percentage of "/w/-present"

$$\left(\frac{\text{the number of "/w/-present"}}{6 - \text{the number of "ambiguous"}}\right) \times 100$$

2.3 Results and discussion

I organized the results in terms of three categories under which /w/ deletion can occur: place of articulation of the preceding consonant, the phonological features of a following vowel, and syllable position within a word. For each of the three factors, I will show the results by using tables and discussion.

2.3.1 Place of articulation of the preceding consonant

Following Silva (1991: 155) and others (e.g. Ahn 1998: 35-46), I assume that the 19 consonant segments are located at five different places of articulation. Table 3 shows /w/ deletion results based on the five different places of the articulation of consonants and on the different following vowels.

Table 3: /w/-presence percentages depending on places of articulation of preceding consonants and the following vowels

Consonants	/wi/	/we/	/w/	/wa/
bilabial	–	67	33	60
alveolar	39	83	100	100
palatal	44	94	100	100
velar	41	83	100	100
glottal	83	100	100	100

As mentioned above, both Silva (1991) and Kang (1996) considered the preceding consonant to be the most major factor in labiovelar glide deletion, even though the two used different features: Silva (1991) suggested that the [+back] feature of velar and glottal consonants inhibits /w/ deletion, while Kang (1996) used the [+labial] feature to explain the noticeable deletion of /w/ after bilabial consonants such as /p/ and /m/. Based on my results shown in Table 3, I will next examine these two suggestions.

As for /w/-deletion after bilabial consonants, Kang (1996)'s explanation has some validity, because we can observe that compared to other consonantal categories, /w/ was more frequently deleted after bilabial sounds. However, Kang's explanation loses its force when we examine the whole range of consonant and labiovelar glide combinations. First, his explanation based on OCP itself is limited to only bilabial consonants. Second, given the status of /w/ as part of the nucleus in a Korean syllable structure, a bilabial consonant does not come before any possible diphthongs: it cannot occur with /wi/ (e.g. */pwi/, */mwi/). Silva's (1991) explanation based on the [+back] feature shared between the preceding consonant and the labiovelar glide seems to work here because, as shown in Table 2, the incidence of /w/ increases as the place of articulation moves backward. Generally, Korean subjects keep /w/ more when preceded by [+back] consonants such as velars and glottals. However, this generalization also has three problematic points. First, even among [-back] consonants, bilabials, alveolars, and palatals show different results, and that is also the case for velars and glottals, which are categorized as [+back]. Silva's study did not cover these cross-consonantal differences. Secondly, he regarded the role of the following vowel as so minor as not to be paid attention to. However, I found that the realization of /w/ after the same consonant varies according to which vowel follows. Finally, /w/ in the same syllable structure (e.g. velar + labiovelar glide+ /i/) is deleted differently depending on where the syllable appears in a word. For example, /kwi/ loses /w/ more often when it comes in a non-initial position within a word, such as in tangnakwi 'donkey,' while /w/ is kept more frequently in word-initial position, such as in kwiga 'ear (Nom).'

In conclusion, Kang (1996)'s OCP-based explanation cannot explain all CGV structure in terms of the different places of articulation of the preceding consonant. And Silva (1991)'s account needs to be supplemented with consideration of the quality of the following vowel and the syllable's position within a word. In the next section, I will take up the roles of vowel quality and syllable position as they affect /w/-deletion in Korean.

2.3.2 Following vowel

To examine the role of the following vowel in CGV(C) structure, I assume that in the Korean vowel system, /e/ and /ɛ/ have merged to /e/ in pronunciation, even though they are still distinguished in spelling (Ahn 1998: 57, Silva 1991: 166). Therefore, I will assume that /we/ and /wɛ/ are pronounced the same in modern Korean. Table 3 shows the influence of the following vowel on /w/-deletion. Regardless of the preceding consonant, /w/ deletion shows the same pattern: /w/ is deleted more before front vowels than before non-front ones. For example, in /velar consonant + w + V/ sequences, /w/ is kept only 41% and 83% of the time when it is preceded by /i/ and /e/, respectively, while /w/ is not deleted at all in front of /ə/ and /a/. This general pattern can be explained in terms of the [back] feature shared by the vowel and the labiovelar glide/w/ as shown in Figure 3.

Figure 3: Feature matrix of /w/ and following vowels

Feature	i	e	ɛ	ə	a	w
[round]	-	-	-	-	+	+
[front]	+	+	+	-	-	-
[back]	-	-	-	+	+	+
[low]	-	-	+	-	+	-
[high]	+	-	-	-	-	+

The vowels which can occur with /w/ can be divided into two groups based on frontness-backness: front (i, e, ɛ) vs. nonfront (ə, a). Considering the [+back] feature of the labiovelar glide, /w/ is more likely to be deleted in front of [-back] vowels than [+back] vowels if we assume

that the [+back] glide is more difficult to pronounce before a front vowel than before a back one. As an approximant which has a relatively short duration of articulation, /w/ loses its [+back] quality when preceded by [-back] vowels.

In summary, this section shows that the backness of the following vowel plays a major role in /w/ variation phonetically. While we have looked at /w/ deletion within a syllable in this section, in the next, I will discuss this variation across different syllable positions within a word, that is, how syllable position can affect the deletion of /w/.

2.3.3 Syllable position

Guided by Kang (1996), I analyzed my data into two groups depending on the position of the syllable within the word: initial position vs. non-initial position. The results based on syllable position are given in Table 4. I excluded /Cwə/ and /Cwa/, where the labiovelar glide was pronounced 100 percent of the time.

Table 4: /w/ presence percentages depending on syllable position in the word

CwV	syllable position	/w/ presence (%)
Cwi	initial	48
	non-initial	18
Cwe	initial	85
	non-initial	66

The labiovelar glide in word-initial syllables is less likely to be deleted than in non-initial syllables. This can be attributed to different prosodic quality between the initial part and the non-initial parts of a word. The initial part of a word is more prominent in prosodic quality than the medial or final parts. Therefore, the initial syllable of a word is more fully pronounced than non-initial syllables.

2.4 Summary

Silva's (1991) and Kang's (1996) analyses of the "disappearing w" in Korean are very thorough and essentially accurate in that they pointed out that labiovelar glide deletion in Korean is a variable process conditioned by many factors. Prompted by these two earlier studies, I paid more attention to the factors which Silva and Kang did not consider as significant: the [-back] feature of the following vowel and /w/'s non-initial position in the word. It was shown that both of these are more major factors than the place of articulation of the preceding consonant, which was considered to be the main factor by Kang and Silva.

So far from the Korean study, it has been shown that Korean subjects deleted /w/ as described in Figure 4.

Figure 4: /w/-deletion in Korean

a. GV(C): /w/ behaves like an onset, not deleted

b. CGV(C): as a part of nucleus, /w/ is deleted when it is preceded by [-back] vowels and when it is placed in non-initial syllable position in the word

Based on the results, I carried out another study with Korean learners of English in order to see if there is L1 transfer when Korean learners delete /w/ in their English learning.

3 /w/ deletion in English

3.1 Method

The data were collected in Spring 2003 in Milwaukee, Wisconsin. The subjects were 10 native speakers of Korean who were staying in Milwaukee at the time of data collection. Their age ranged from 20 to 42 years old. Degree of exposure to native English was also as various as their age: from 2 months to 20 years. Half of the subjects were students of the University of Wisconsin-Milwaukee and the other half were immigrants who had formal English education a long time before the interview. 4 out of 10 were females. Their regional background from Korea also varies, which, I assume, has little influence in this study.

The speech data were from interviews with the subjects. They were asked to read casually a made-up story which consisted of words with /w/. The story was created to have a single storyline to distract the subjects' attention from pronunciation (see Figure 6, page 62). Before they started to read, all the subjects were told that there was no correct or wrong pronunciation. While they were reading the story in a quiet place, they were tape-recorded.

After recording the subjects, the data were evaluated by me and a native speaker of English who had a linguistics background. The subjects' pronunciation was divided into three categories: '/w/-presence', '/w/-absence' and 'ambiguous' for each token. The total number of words was 31 and it made 310 tokens in total (10 tokens for each word). After dividing each token into three categories, the percentage of /w/ presence was given for each word. The number of 'ambiguous' cases was excluded from the total number of tokens when calculating the percentages (see Table 8, page 63). The percentage of /w/ presence in each word was calculated as in Figure 5.

Figure 5: Percentage of "/w/ presence" in each word

$$\left(\frac{\text{the number of "/w/-present"}}{10 - \text{the number of "ambiguous"}} \right) \times 100$$

3.2 Results

3.2.1 Dichotomy based on orthography

Table 8 shows interesting results. In words 1 to 15, the subjects deleted the /w/ significantly compared to the words 16 to 31. This difference is attributable to the spelling effect because the words 1 to 15 have 'CuV' sequences in spelling while the others have commonly 'CwV' sequence. In other words, the subjects generally showed a dichotomy based on two orthographic structures: when a word had a 'w' in spelling they tried to pronounce the labiovelar glide, while there was no 'w' in spelling, /w/ was deleted more.

3.2.2 'CuV' structure in orthography

When the Korean speakers of English pronounced words which have 'u' instead of 'w' in spelling after a consonant and before a vowel, interestingly, they showed the same patterns with /w/ deletion in Korean. That is, my L2 data results showed the same /w/-deletion variants as in L1. The subjects deleted /w/ more when it came before [-back] vowels or in non-initial syllable position in the word as shown in Tables 5 and 6.

In the study of /w/ variation in English, two interesting results were drawn from L2 data. First, the subjects seemed to be influenced by the presence of the letter 'w' in a word: when there is 'w' in spelling, they pronounced /w/ more clearly than in words with 'u' in spelling. Second, as for spelled sequences of consonant + vowel 'u' + another vowel, the Korean speakers

Table 5: /w/ presence depending on following vowel in English

Vowel types	CGV(C)	/w/ presence (%)
[−back]	Cwi	61
	Cwe	67
	Cwæ	78
[+back]	Cwə	85
	Cwa	98

Table 6: /w/ presence depending on syllable type in English

Syllable type	/w/ presence(%)
Initial	81
Non-initial	60

of English applied the /w/ deletion rules from their native language. In the following section, these interesting results will be discussed in more details.

3.3 Discussion

3.3.1 L1 transfer in learners' perception as a rule trigger

As shown above, Korean learners showed a strong tendency to produce /w/ in English words in two different ways depending on orthography. That is, as for the words with 'w' after consonant in spelling, the /w/ was rarely deleted, while in words which had the letter 'u' after a consonant, more frequent deletion of /w/ was observed (see Table 8, page 63). This dichotomy seems to be attributable to the phonetically complex nature of the Korean labiovelar glide /w/: when /w/ behaves like an onset of a syllable, it is not deleted, while if it is part of the nucleus it is deleted more. This generalization becomes valid when explaining the results of Korean learners of English. As for the words containing 't, s, d, g + w + V' sequences in spelling, the Korean learners hardly deleted the glide (see Table 8, words 16-31). In order to keep the /w/ in their pronunciation, they resyllabified these words. First, they inserted a vowel [ɨ] after the first consonant. As a result, the glide /w/ became an onset of the next syllable, being pronounced with its full prosody. For example, the word 'twin' [twin] is pronounced as [tɨ.win].[2] On the other hand, when it comes to English words with the letter 'u' instead of 'w', the subjects deleted the labiovelar glide /w/ more frequently. It was shown that the Korean learners perceived the /w/ as part of the nucleus, and they applied the /w/-deletion rule from their native language.

3.3.2 L1 transfer in CuV structure

The first major factor in /w/-deletion in the Korean data was the [-back] quality of the following vowel. As we can see from Table 5, there is also a tendency to delete /w/ more when it comes before [-back] vowels such as [i], [e] and [æ], while it is deleted much less frequently before [+back] vowels such as [ə] and [a].

The second major factor determining /w/-deletion in Korean is where /w/ is placed in a word. In Korean, the labiovelar glide /w/ in word-initial syllables is deleted less than in non-initial syllables. As shown in Table 6, this factor works the same in the L2 by Korean learners. When

[2]This resyllabification process is commonly observed in Korean with borrowed words from foreign languages which allow consonant onset clusters. Because Korean doesnt allow onset clusters, native speakers of Korean tend to break up one syllable by inserting a vowel (Eckman and Iverson 1993).

the labiovelar glide is placed in one syllable word such as quiz or queen, it was observed that the subjects pronounced the /w/ more consciously. As for words with two or more syllables, the syllable position of /w/ caused different /w/-deletion rates. For example, in the word quickly they showed a 75% /w/ presence rate, while in words such as acquisition and language, they pronounced /w/ only 55% and 30% respectively. In short, Korean learners deleted the /w/ based on syllable position just like they did in their native language.

In section 3.3, it was argued that the "disappearing /w/" in English words as pronounced by Korean learners is not just an idiosyncratic phenomenon, but an L1 transfer. As they looked at the words, the complex status of /w/ in Korean triggered the two different perceptions of the /w/ in English. Korean learners perceived the labiovelar glide as either an onset or part of the nucleus, even though it is always an onset consonant in CwV sequences in English (Davis and Hammond 1995: 161). Next, they applied the /w/ deletion rules of Korean to their L2. When they perceived /w/ as onset, they did not delete the glide but, instead, they inserted a vowel after the first consonant. On the other hand, when they perceived the glide as part of the nucleus, the deletion of the labiovelar glide was conditioned by the same factors as in Korean: the following vowel and syllable position.

4 Conclusions

In this paper, the variant pronunciation of the labiovelar glide /w/ in the English of Korean learners was examined. I claimed that when there was a preceding consonant, /w/ deletion in Korean was conditioned by two major factors: the quality of the following vowel and syllable position. Two generalizations were made about the Korean data:

1. The labiovelar glide was deleted more in front of [-back] vowels.
2. The labiovelar glide was deleted more in non-initial syllables.

Guided by these two rules of /w/ deletion in Korean, I examined if /w/ deletion in English by Korean learners can be attributed to L1 transfer. The Korean subjects showed a strong tendency to pronounce the labiovelar glide in English words following various Korean /w/ deletion rules. Korean learners perceived /w/ in two different ways: either onset or part of the nucleus of a syllable. When they perceived /w/ as onset, /w/ was not deleted, while when they perceived /w/ as part of the nucleus they deleted it more frequently. I suggested the existence of 'w' in spelling as a trigger for these different perceptions. Deleting /w/ frequently in their L2 learning, Korean learners showed the same patterns of /w/ deletion in their native language; First, they deleted /w/ more often in front of front vowels such as /i/, /e/ and /æ/ than in front of /ə/ and /a/. Second, the labiovelar glide was deleted more frequently in non-initial parts of words, while the learners pronounced /w/ more in the initial syllable of words.

Table 7: '/w/-presence' rate for Korean words

'WP' stands for '/w/-presence rate, as a percentage frequency (%)

words	meaning	WP	words	meaning	WP
pwayo	look at	50	chwemyeon	hypnosis	83
ipwayo	hey!	50	chwaseok	seat	100
mweorako	what?	33	kyechwabunho	account number	100
mweneun	mountain (Nom.)	67	ancweosseoyo	didn't give	100
twismun	back door'	67	kwemul	monster	100
twikim	deep fried	50	kwisin	ghost	50
twechi	pig	83	hankweonwi	one volume of	100
antwe	no	83	chaekkwa	book and..	100
keutwie	behind it	40	kwaja	snack	100
namutwi	behind a tree	17	kwail	fruits	100
tweora	put!	100	sakwa	apple	100
swirako	to rest	33	kwanghwamun	Kwanghwa Gate	100
motswiko	can't rest	33	wangkwan	crown	100
swiwəta	to be easy (Past)	33	kwansok	in a coppin	100
swekoki	beef	83	hwekwan	center	100
yəolswe	key	67	kwaenchana	it's okay	67
swekorang	chain	100	kweonko	advice	100
swara	shoot!	100	kwinun	ear(Nom.)	33
chwieop	employment	50	dangnakwi	donkey	0
chwichukendeut	so quiet	67	hweolssin	much more	100
sulčwihan	be drunken	17	hwasal	arrow	100
sangcwi	rat	0	hwamul	baggage	100
sokcwe	repentance	100	hwiparam	whistle	83
cwein	sinner	100			

Figure 6: English data test

On Wednesday, I had a quiz. It had twelve questions. The teacher gave us twenty minutes but I finished quickly. It was Second Language Acquisition class, which was required for my M.A. degree. Everybody's so quiet in the class.

In the afternoon, my boss requested me to quit my job because I'm not qualified. But I swear I am!!! On my way to home in despair, I met a really sweet girl. Her name was Gwen and she's from Swiss and has a twin sister. Her eyes were like twinkle stars in the sky, queen of the night. We went aquarium. When she saw me sweating, she asked to go swimming. She told me I'm a man of etiquette.

I went to emergency room because I swallowed a quarter by accident. But the doctor was quack and his name was Twain. He twisted the cap of the squeezed orange juice bottle. And he stirred it with a twig. He also said that city dwellers between twenty-first and twenty-second street suffer from higher pollution levels and the supply of food had dwindled to almost nothing.

Table 8: '/w/ -presence' rate for each English word

	Word list	Application1	Application2	Mean (%)
1	quiz	60	80	70
2	quickly	60	50	55
3	question	50	100	75
4	quiet	100	100	100
5	quit	60	78	69
6	qualified	100	100	100
7	queen	100	80	90
8	acquisition	60	50	55
9	language	20	40	30
10	required	90	100	95
11	requested	60	60	60
12	aquarium	50	100	75
13	quarter	60	100	80
14	quack	70	88	79
15	squeeze	30	60	45
16	swear	100	100	100
17	sweet	100	100	100
18	twenty	100	100	100
19	twelve	100	100	100
20	Gwen	100	100	100
21	Swiss	100	100	100
22	twin	90	100	95
23	twinkle	100	80	90
24	sweat	100	100	100
25	swim	100	100	100
26	swallow	100	100	100
27	Twain	100	100	100
28	twist	90	100	95
29	twig	90	100	95
30	dweller	90	100	95
31	dwindle	100	100	100

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