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VOWEL DEVOICING IN TOKYO JAPANESE: A VARIATIONIST APPROACH

By

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ABSTRACT

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This study investigates variation in Japanese vowel devoicing within a variationist framework. There are numerous studies of this phenomenon, but only a few investigate its social aspects; Yuen (1997) reports style and gender differences, and age difference are reported by Maekawa (1988); no study has investigated the effect of social class. Previous studies have also been based on extremely limited data, but this study uses a large corpus, incorporating both social and linguistic factors.

The linguistic factors are vowel identity, preceding and following consonants, morpheme boundary type, pitch accent pattern, and consecutive devoicing environments. The social factors are age, sex, social class, and style. Data from 42 respondents' tape –recorded interviews were analyzed instrumentally for voicing and treated to a logistic regression statistical analysis.

Effects of the preceding and following consonant, accent, morpheme boundary, consecutive devoicing, and style confirm previous studies, but the claim that devoicing is prohibited between two fricatives (Tsuchida 1997) was not supported, and vowel identity was statistically significant, contrary to Han (1962) and Maekawa (1983). Previous claims about the effect of age in the devoicing of accented vowels, interaction between accent and the following consonant, and

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interaction between morpheme boundary and the following consonant were not completely supported, and the effect of morpheme boundary in a consecutive devoicing environment was also not supported. Finally, the earlier study of the effect of sex was not entirely supported because sex and age show an interaction; younger males devoice most, and younger females devoice least, but sex differences are weak or nonexistent in middle-age and older respondents.

New findings in this study include the following: [ʃ] and [p] behave differently from other obstruents; pitch associated with the vowel, rather than the word accent, was found to be important; morpheme boundary was found to be a significant factor, but only a word level boundary demotes devoicing, and devoicing is also demoted in a consecutive devoicing environment even though the previous devoiceable vowel was not actually devoiced.

Social factors show a mixed pattern regarding standardness. Style, age/sex patterns, and articulatory data suggest that devoicing may be nonstandard, but the social class pattern (for /u/ only), speaker perception, and prescriptive authority suggest it is a standard feature. In order to account for this mixed pattern, several possible accounts are suggested: (1) phonological vs. phonetic devoicing (Tsuchida 1997) may be related to the perception of standardness, (2) language change may be occurring among younger speakers, or a combination of these two may be able to account for this mixed pattern, or (3) a purely variationist approach in which various segments of the society associate themselves with certain levels of performance may account for the pattern.

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CHAPTER 1

INTRODUCTION

This study investigates the variation in Japanese vowel devoicing within a sociolinguistic (variationist) framework, looking at social factors as well as linguistic factors. Earlier research suggests that the Japanese high vowels /i/ and /u/ are usually devoiced when they occur between voiceless consonants or between a voiceless consonant and a pause (Sakuma 1929, Martin 1952, Han 1962, McCawley 1968, Kawakami 1977, Nihon Hoosoo Kyookai (NHK) 1985, Vance 1987, Maekawa 1983 and 1988, Sugito 1988, Kondo 1995, Nagano-Madsen 1995, Tsuchida 1997, Yuen 1997, Varden 1999). Japanese vowel devoicing has attracted many researchers and has been well studied in the fields of phonetics and phonology (Han 1962, McCawley 1968, Maekawa 1983, Beckman and Shoji 1984, Vance 1987, Sugito and Hirose 1988, Kondo 1994 and 1995, Nagano-Madsen 1995, Tsuchida 1997, Varden 1999), but no thorough sociolinguistic investigation has been done.

Although it is believed that vowel devoicing is more likely to occur in casual, rapid speech than in slower, more formal speech, most of the phonetic and phonological studies on Japanese vowel devoicing used controlled data, such as reading framed sentences or isolated words. There are few quantitative studies that have looked at the differences in devoicing in different speech styles. Yuen (1997) shows that the more casual the speech style becomes, the more frequently devoicing occurs and that men devoice more than women. In

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particular, his results show that women resist devoicing in the most formal speech style; formal reading style. With these results, one might think that vowel devoicing in Japanese is a nonstandard feature because it occurs more frequently in more casual styles and men use it more than women. However, vowel devoicing is also considered a standard feature in Japanese; the *Japanese Pronunciation and Accent Dictionary* (NHK 1985) indicates where vowels should be devoiced in standard Japanese, and the perception of the Tokyo dialect speakers suggests that it is a standard Tokyo feature. Considering these facts, one can ask questions such as "why does a standard feature happen more frequently in casual conversation?" and "why do men use the feature more than women, if it is a standard feature?"

The present study investigates these apparent contradictions by looking at age, sex, social status, and speech style, which are common social factors used in variationist sociolinguistics studies (see Chapter 3) and tries to suggest an answer to this apparently contradictory pattern.

Although linguistic factors have been much more thoroughly treated than social ones in previous studies of vowel devoicing, they have all too often been derived from casual observation or very limited studies of actual speech samples. This work focuses, therefore, secondarily, on the claims of previous research made about such factors. The linguistic factors used in this study are vowel identity, the identity of the preceding and following consonants, morpheme boundary type, pitch accent pattern, and consecutive devoicing environments, which are commonly discussed in phonetic/phonological studies of Japanese

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vowel devoicing (see Chapter 2). It is hoped that, by investigating these factors quantitatively in different speech styles, natural language usage will provide supplementary information to previous studies.

In the following subsections, I will provide some background on the Japanese language; I will first introduce Japanese phonology (1.1) and morphology (1.2); and then discuss my research questions and hypotheses (1.3).

1.1 Japanese phonology

The basic Japanese syllable structure is (C)V. A coda is allowed only when it is a part of a geminate, when it is a nasal followed by a stop, fricative, or affricate that shares the place feature with itself, or when it is a moraic nasal.

In the following, I will first briefly summarize the role of mora in Japanese (1.1.1), then introduce Japanese phonemes (1.1.2), and outline the Japanese accentuation system (1.1.3).

1.1.1 Syllable vs. mora

Japanese is a mora-timed language, which means that the basic phonological unit that native speakers perceive is a mora. For example, in the English word *London*, there are two syllables (*Lon.don*), but Japanese speakers perceive it as having four moras (*Lo.n.do.n*) (Tsujimura 1996). This is also

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reflected in their writing system, in which one symbol represents one mora[1]. This distinction between syllable and mora is also important in considering the pitch accent system in Japanese (cf. 1.1.3 below).

1.1.2 Japanese Phonemes

Japanese has five vowels: /a, i, u, e, o/. /a, i, e, o/ are phonetically transcribed as [a, i, e, o], but /u/ is usually an unrounded high back vowel, phonetically transcribed as [ɯ] (Tsujimura 1996).

Japanese consonants consist of stops, fricatives, affricates, approximants, and nasals. Table 1.1 shows the inventory of the (major) Japanese consonants[2] based on Tujimura (1996) and the IPA.

Table 1.1: Phonetic Inventory of Japanese Consonants

		bilabial	alveolar	aleveo-palatal	palatal	velar	uvular	glottal
Stops	voiced	b	d			g		
	voiceless	p	t			k		
Fricatives	voiced		z					
	voiceless	ɸ	s	ʃ	ç			h
Affricates	voiced		dz	dʒ				
	voiceless		ts	tʃ				
Approximants								
liquids	voiced		ɾ					
glides	voiced				j	w		
Nasals	voiced	m	n			ŋ	ɴ	

[1] Small 'ya', 'yu', and 'yo', which form a part of a palatalized sound in combination with the preceding letter, are exceptions to this; e.g, ひゃ ('hi' + small 'ya'='hya').
[2] There are other consonants, such as alveo-palatal and palatal nasals, which are caused by assimilation to the following consonant, but they are excluded here for sake of simplicity.

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All the (oral) stops (/p, b, t, d, k, g/) are phonemes in Japanese. The phonemic status of the fricatives and affricates, however, is not so simple. For example, [s] occurs before the vowels /a/, /u/, /e/, and /o/, but not before /i/. [ʃ] occurs before /i/ instead. However, [ʃ] can also occur before /a/, /e/ (in recent loan words), /u/, and /o/; therefore, it is considered a phoneme. A similar alternation occurs with its voiced counterpart /z/. [z] occurs before the vowels /a/, /u/, /e/, and /o/, but not before /i/. [dʒ] occurs before /i/ instead, but since [dʒ] can occur before /a/, /e/ (in recent loan words), /u/, and /o/ also, it is considered a phoneme. Similarly, [t] occurs before non-high vowels /a/, /e/, and /o/, but not before the high vowels /i/ and /u/. [tʃ] occurs before /i/ and [ts] before /u/. [ç], [ɸ], and [h] are other examples that show similar alternation. [h] occurs before non-high vowels /a/, /e/, and /o/, but not before the high vowels /i/ and /u/. [ç] occurs before /i/ and [ɸ] occurs before /u/. Thus, it seems that [tʃ] and [ts] are allophones of /t/, and [ç] and [ɸ] are allophones of /h/. However, there are cases where those sounds occur before other vowels, as in [tʃa] 'tea', [móotsaɾɯto] 'Mozart', [çakɯ] 'hundred', and [ɸóokɯ] 'fork,' respectively. Some of these words are recent loan words, but others are not. Therefore, the standard treatment of these sounds is that they are allophones when they occur before /i/ or /u/, but are phonemes when they occur before other vowels (Shibatani 1990, Tsujimura 1996).

Japanese has one liquid /r/, which is similar to flapped [d] in English. It may be phonetically transcribed as [ɾ]. Other approximants are the glides /j/ and /w/.

Japanese nasals include [n], [m], [ŋ], and [ɴ]. [n] and [m] occur in the onset position, but [ɴ] occurs in the coda position. [ŋ] is considered as an allophone of /g/ or /n/ because it only occurs intervocalically, as in /kagami/ [kaŋami] 'mirror' (at least among older speakers), or before a palatal stop as in /kangaeru/ [kaŋgaeru] 'to think'; it never occurs in the onset position. On the other hand, Shibatani (1990) posits the phoneme /ɴ/ as a moraic nasal. When it is followed by a pause, it is a uvular nasal [ɴ], but when it is followed by a consonant, it assimilates to the following consonant and changes its place of articulation. However, it is possible to consider it as an allophone of /n/, and "n" is the standard spelling (in romanization) for the coda nasal. Tsujimura (1996) seems to take this position; /n/ is realized as [n] in the onset position, as [ɴ] before a pause, and as [n], [m], or [ŋ] before another consonant due to a place assimilation.

1.1.3 Japanese Accentuation System

Japanese is a pitch-accent language, in which each mora is associated with a specific pitch, and "the pitch or tonal pattern of the entire word is predictable given the location of the accent of a word" (Tsujimura 1996: 74). In

Japanese, each mora is associated with either high (H) or low (L) pitch, and pitch accent pattern is phonemic; a different pitch accent pattern with the same segmental sequence may result in different words. Shibatani (1990) gives an example of three-way distinction of the same segmental sequence /haʃi/ in the Kyoto dialect, as in (1).

(1)	/haʃi/	a.	HH	'edge'
		b.	LH	'chopsticks'
		c.	HL	'bridge'

In Japanese, accent is on the mora with a high-pitch followed by a low-pitch, as shown in (2), taken from the Tokyo dialect, where '+' indicates a bound morpheme boundary, '#' a compound word boundary, and '##' a word boundary.

(2)	a.	kúmo	HL	'clouds'
	b.	kawá(##ga)	LH(L)	'river-Subj.'
	c.	kan+kaku#kí+kan	LHHHHLL	'sense organ'

In a word with an accent on the final mora, as in (2b), we can tell that the accent is on the final mora by attaching a particle such as *ga*. Once we know the accent location, the pitch accent pattern of the rest of the word is predictable in the Tokyo dialect. All the moras preceding the accented mora receive a high-pitch, and the initial mora receives a low-pitch by the Initial Lowering Rule

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(Haraguchi 1977), as in (2c). Thus, pitch accent can be different within a single syllable (*kan* in 2c), which shows that the pitch accent-bearing unit in Japanese is a mora.

1.2 Brief discussion of Japanese morpheme types

In the present study, morpheme boundary is included in order to see the influence of different morpheme types on vowel devoicing (see Chapter 2). I will discuss only the relevant parts of Japanese morphology here, namely, morpheme types.

Japanese, like other languages, has free morphemes, such as nouns, adjectives, and verbs, and bound morphemes, such as verbal conjugation endings (inflectional morphemes) and prefixes (derivational morphemes), as shown in (3), taken from Tsujimura (1996: 142-143). (3a-d) show verbal and adjectival conjugation endings, and (3e) and (3d) show the prefix 'su-'.

(3)	a.	tabe-ru	'eat-Non-past tense (verb)=eat, will eat'
	b.	tabe-ta	'eat-Past tense (verb)=ate'
	c.	ooki-i	'big- Non-past tense (adjective)=is big'
	d.	ooki-kat-ta	'big-Past tense (adjective)=was big'
	e.	su-asi	'bare leg'
	f.	su-hada	'bare skin'

Japanese is also rich in compounding. Shibatani (1990) gives ample examples of different types of compounding, such as native compounds, Sino-Japanese compounds, and hybrid compounds (237-238), some of which are reproduced in (4) below.

(4)	a.	aki-zora	Native, Noun-Noun	'autumn sky'
	b.	tatʃi-yomi	Native, Verb-Verb	'reading while standing'
	c.	ki-soku	Sino-Japanese	'rule'
	d.	ita-tʃoko	Hybrid, native-foreign	'chocolate bar'

(4a) is an example of a native compound where two nouns are combined; *aki* 'autumn' and *sora* 'sky'. (4b) is another example of a native compound, but two verbs are combined; *tatsu* 'stand' and *yomu* 'read'. (4c) is an example of a Sino-Japanese compound, but both *ki* and *soku* are bound morphemes (and as a unit, means 'rule'), unlike other examples in (4), in which both members of the compounds are free morphemes. Finally, (4d) is an example of a hybrid compound, in which a native word *ita* 'board' and a foreign loan word *tʃoko* 'chocolate' are combined.

These are the distinctions used in the present study: free vs. bound morphemes, and within free morphemes, compound boundary vs. word boundary (across different grammatical categories, such as verbs, nouns, adjectives).

Of course there are many other features of Japanese; this study is not a grammatical survey of the language. I have attempted here only to provide background information on the language features that will prove important to the consideration of the distribution and occurrence of vowel devoicing as it may be influenced by these factors.

1.3 Research Questions and Hypothesis

The specific questions to be answered in the present study are the following:

1. Which preceding and following consonants promote devoicing?
2. Is there an interaction between the preceding consonant and the following consonant?
3. Does vowel identity have any influence on Japanese vowel devoicing?
4. Does morpheme boundary have an effect on devoicing, and if so, in all styles? Is there a difference among different morpheme types?
5. Does pitch accent have any effect on devoicing? If so, does it have the same effect for different age groups?
6. Is vowel devoicing demoted in a consecutive devoicing environment? What is the actual behavior in a speaker's natural usage?
7. Does the devoicing rate change in different styles?
8. Is there any difference between men and women in terms of devoicing?
9. Do different age groups behave differently in terms of devoicing?
10. Do different social classes behave differently in terms of devoicing?

I will provide a detailed hypothesis to each question related to linguistic factors (1) through (6) in Chapter 3. As for (7), according to Yuen (1997), there are stylistic differences, and the more casual the style becomes, the more devoicing occurs. As for (8), Yuen (1997) shows that there is a difference and that men devoice more than women. As for (9), there are some reports that the younger generation behaves differently from older generations in term of the devoicing of accented vowels (refer to Chapter 2 for details). As for (10), if vowel devoicing has a social meaning, i.e. degree of standardness, then we should expect some different behaviors in different social classes if it is indeed a nonstandard feature; lower social class speakers with a higher percentage of devoicing, and higher social class speakers with a lower percentage because the pattern in style and sex differences suggest this may be a nonstandard feature. We would also expect that the age group that is most sensitive to social prestige will be least likely to devoice vowels in a more formal style. In all these cases, however, it will be important to recall that devoicing is considered standard (in some environments) in Tokyo Japanese, according to both dictionaries and speaker perception.

1.4 Organization

In the next chapter, I will provide an overview of the issues commonly touched on in discussions of Japanese vowel devoicing. Chapter 3 provides

detailed information on the variables used in the present study, both linguistic and social, coding of those variables, and data collection and handling procedures. Chapter 4 discusses the results of the statistical analyses of the data, and Chapter 5 provides the detailed discussion of the results. Finally, Chapter 6 concludes with a summary, proposed interpretations of the results, and further research suggestions.

CHAPTER 2

BACKGROUND

In this chapter, I will first review different accounts of vowel devoicing in Japanese, then discuss the linguistic and social factors that have been argued or assumed to affect Japanese vowel devoicing.

2.1 Phonological and phonetic accounts of Japanese vowel devoicing

Japanese vowel devoicing has been traditionally described as a phonological process, in which the feature [-voice] spreads from neighboring voiceless obstruents to a high vowel (/i/ or /u/) in an unaccented syllable (McCawley 1968, Vance 1987). However, as summarized in Tsuchida (1997), this is controversial. Some studies show that there is a difference in the effect of preceding and following consonants on vowel devoicing between fricatives and stops. A preceding fricative seems to promote devoicing more than a preceding stop (Han 1962, Maekawa 1983 and 1988, and Tsuchida 1997) and a following stop more than a following fricative (Takeda and Kuwabara 1987 and Yoshida and Sagisaka 1990 [cited by Nagano-Madsen 1995], Nagano-Madsen 1995). If vowel devoicing is due to the [-voice] spreading, it should not show different degrees of effect between fricatives and stops since both are specified for [-voice]. It has also been pointed out that devoicing between two fricatives is less likely to occur (Sakuma 1929 [cited in Tsuchida 1997], Tsuchida 1997). The phonological [-voice] spreading approach cannot explain this tendency either.

Another problem with the [-voice] spreading account is that more recently the feature [voice] has been argued to be a privative feature, not a binary one (e.g. Lombardi 1991). Therefore, the argument that vowel devoicing is a phonological (categorical) rule of [-voice] feature spreading cannot be entirely supported.

Some researchers argue that vowel devoicing is a phonetic vowel reduction process due to a glottal gestural overlap (Jun and Beckman 1993, Kondo 1994). However, if Japanese vowel devoicing is due to a phonetic vowel reduction process, it is difficult to account for the fact that high vowels in different consonant environments are more or less likely to devoice (Sakuma 1929, Tsuchida 1997). A vowel reduction approach also cannot account for the fact that in a consecutive devoicing environment, in which there is more than one devoiceable vowel in a row, devoicing of both vowels in the two successive syllables is avoided (Han 1962, Maekawa 1988, Tsuchida 1997 among others, see 2.2.4. below for more details).

Tsuchida (1997) argues that there are two types of vowel devoicing in Japanese: phonological and phonetic. She argues that voiceless fricatives and devoiced vowels are both specified for [spread glottis] ([s.g.] hereafter) based on the articulatory data, and that when a high vowel occurs next to a voiceless fricative and devoiced, it receives [s.g.] from the neighboring fricative in a phonological operation. When a high vowel comes between two stops, the feature [s.g.] is inserted by a Gen operation. This is articulatorily supported because the devoiced vowel and the neighboring voiceless consonants are produced with a single glottal opening. Tsuchida further argues, based on the

facts that a high vowel between two voiceless fricatives is less likely to devoice, (NHK 1985, Tsuchida 1997), that vowel devoicing is prohibited in phonology when a high vowel occurs between two fricatives. She also argues that, when the vowel is devoiced in that environment, two glottal openings were observed, instead of one observed in other environments of phonological devoicing. She accounts for this restriction by an OCP violation, which is caused by having two [s.g.] features in a row when the vowel is devoiced, where the feature [s.g.] is shared by the preceding voiceless fricative and the devoiced high vowel. This is schematically shown in (5) below.

(5) 

Tsuchida also argues, based on the fact that the devoicing before allophones of /h/ ([h], [ɸ], and [ç]) is less likely to occur (NHK 1985, Nagano-Madsen 1995, Tsuchida 1997), that the feature [s.g] cannot be shared across syllables (i.e. by a high vowel and the following /h/) because /h/ does not have a supralaryngeal node.

However, it is well known that devoicing sometimes occurs in the following environments: (1) when a high vowel occurs between two voiceless fricatives (Sakuma 1929, NHK 1985, Tsuchida 1997), (2) when a high vowel occurs before an allophone of /h/ (Sakurai 1985, Tsuchida 1997), (3) when a high vowel occurs after a voiceless consonant and before a voiced consonant (Han 1962, Maekawa

1988, Tsuchida 1997), and (4) when a non-high vowel occurs between voiceless consonants (Maekawa 1988, Tsuchida 1997). Tsuchida (1997) claims that these are all cases of phonetic devoicing caused by undershooting a target. If the goal is total voicing, sometimes speakers fail to reach the target, resulting in phonetic devoicing.

Since the scope of this study is primarily to determine social factors in Japanese vowel devoicing, I will not seek to determine if vowel devoicing is a phonetic process, phonological rule, or a combination. I use the phonetic identity of the preceding and following consonants rather than their features in my characterization of units and environments, although I will make some reference to those features in the discussion of my findings.

Nevertheless, a careful acoustic analysis suggests that devoicing in some of the environments which Tsuchida calls "phonetic" are as completely devoiced as others which she suggests are sanctioned, and they are acoustically indistinguishable.

2.2 Linguistic factors

In this section, I will discuss the major linguistic factors that affect Japanese vowel devoicing; i.e. preceding and following consonants, vowel identity, accent, consecutive devoicing environments, and morpheme boundary types.

2.2.1 Preceding and following consonants

The effect of preceding and following consonants is the most discussed factor of vowel devoicing in Japanese. As mentioned in the previous subsection, it has been pointed out that fricatives and stops (and affricates) have a different degree of effect on the frequency of vowel devoicing in Japanese. A preceding fricative promotes devoicing more than a stop or an affricate (Han 1962, Maekawa 1983, Kondo 1997, Yuen 1997) and a following stop, more than a fricative (Takeda and Kuwabara 1987, Yoshida and Sagisaka 1990 [cited by Nagano-Madsen 1995], Nagano-Madsen 1995, Yuen 1997). However, researchers disagree on which part of the context has a stronger effect on vowel devoicing, namely, the preceding consonant or the following consonant.

Traditionally, it was assumed that the preceding consonant has the most significant effect on vowel devoicing in Japanese. Han (1962) says that a vowel following an affricate is "more unvoiced" (89) than one following a stop, which is generally not unvoiced, and that fricatives "show greater effect on the unvoicing of the vowel" (89) than affricates. However, information about her respondents and the details of the experiments are not provided. She also limited the following consonant to [k]. Maekawa (1983) also found, in his acoustic analysis of 10 minutes of speech of a female TV broadcaster, that a preceding fricative promotes devoicing more than a stop or an affricate. However, he does not provide the following consonant identity. Neither of these studies investigated the importance of the following consonant.

On the other hand, most of the newer phonetic studies of Japanese vowel devoicing show that it is actually a following stop that has a stronger effect on devoicing (Kawakami 1977, Takeda and Kuwabara 1987, Yoshida and Sagisaka 1990 [all cited in Nagano-Madsen 1995], Nagano-Madsen 1995, Yuen 1997). Nagano-Madsen (1995) found, in her acoustic study of a female Standard Japanese speaker's speech using frame sentences, that vowels followed by [ʃ], [ç], and [ɸ] are less likely to devoice, and that the preceding consonant did not show any influence. Kawakami (1977) says, however, that a preceding fricative or an affricate does not promote devoicing even though a preceding stop generally promotes it, contradicting other studies. Yuen (1997) found that a preceding fricative promotes devoicing more than a stop or an affricate, but a following stop promotes devoicing more than a fricative, an affricate, or a pause. He found that the following stop has a statistically stronger effect on vowel devoicing than a preceding fricative. However, Imai's (1997) research, using casual conversational data from four young native Tokyo dialect speakers, found that a preceding consonant identity has a statistically more significant effect on vowel devoicing than a following consonant identity, contrary to Yuen's results. In addition, Imai's (1997) results show that vowel identity is also important. A preceding fricative very strongly promotes the devoicing of /i/, but a preceding stop or affricate, both of which share a [+stop] feature, strongly promotes devoicing for /u/.

Tsuchida (1997) argues, as described in the previous subsection, that the devoicing of a high vowel between two fricatives and before /h/ is prohibited. This

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seems consistent with the claim, made by most phonetic studies, that a following stop promotes devoicing because these two environments, in which devoicing is prohibited, have a following fricative (/h/ is usually categorized as a fricative) in common. Thus, Tsuchida seems to assume that the following consonant identity has a strong effect on vowel devoicing. However, she also seems to agree with the position that a preceding fricative promotes devoicing more than a stop. Yuen (1997) reports that there is an interaction between the preceding and following consonants, e.g., preceding fricatives and following stops promote devoicing. Table 2.1 is Yuen's results of a factorial test for preceding and following consonants, reproduced from Yuen (1997: 31).

Table 2.1: Effect of preceding and following consonants (Yuen 1997)

	DF	F-value	P-value
Preceding Consonant	F (2, 1783)	4.255	0.0143
Following Consonant	F (3, 1783)	38.177	< 0.0001
Preceding * Following	F (6, 1783)	28.201	< 0.0001

The following consonant has a stronger effect on the voicing mean[3] than the preceding consonant because its F-value is higher than that of the preceding consonant. The results also indicate that the combination of the two types of consonant is significant[4]. It is possible that this preceding and following consonant interaction may be the reason for the controversy of which consonant

[3] Yuen (1997) used the measure of "voicing mean" which is calculated based on their voicing status; if the vowel is deleted, it was assigned 0, if devoiced, 1, and if fully voiced, 2.
[4] Yuen (1997) does not provide further details of the interaction.

context has stronger effect on vowel devoicing. However, Imai (1997) did not find a statistically significant interaction between the preceding and the following consonants.

There is also some debate about the effect of a pause. The traditional description of Japanese vowel devoicing is that a high vowel is devoiced when it occurs between voiceless consonants or after a voiceless consonant and before a pause. However, Maekawa (1988) says that an utterance-final pause (including word-final position in words in isolation) has the same influence as a voiceless consonant, i.e., it promotes devoicing, but a sentence-internal pause seems to demote devoicing. This tendency was observed in his study conducted in a town in the Tottori prefecture (in the western part of Japan), in which the respondents were asked to read a passage (he only reports the results of 29 male respondents). However, he seems to attribute the negative influence of a sentence-internal pause to the raised pitch right before a pause, as in *watashi ga jussai no toki*## (the accent mark indicates raised pitch, and '##' marks a word boundary) 'when I was 10 years old,' where it is obligatory that the vowel is voiced (Kawakami 1977, cited by Maekawa). Imai (1997) also found that the following pause demotes devoicing, but, in this study, a mora with a raised pitch before a pause was excluded. Therefore, we cannot account for the negative influence of a sentence-internal pause simply by the pre-pausal raised pitch.

This negative influence of a sentence-internal pause seems to be compatible with at least a part of Sugito's (1988) findings in her study of regional differences of Japanese vowel devoicing, specifically the results from the Tokyo

dialect, because devoicing was demoted before a sentence-internal pause in Tokyo but not in Nagoya (see 2.3.1. below).

To summarize, the relative importance of the preceding and the following consonant is still controversial, but most studies seem to agree that a preceding fricative and/or a following stop promotes devoicing. The effect of a pause seems to differ depending on the position: A sentence-final pause seems to promote devoicing, but a sentence-internal pause demotes it.

2.2.2 Vowel identity

The effect of the vowel identity on vowel devoicing is also controversial. Han (1962) argues that only the high vowels (/i/ and /u/) undergo devoicing because the high vowels are inherently shorter than the non-high vowels (/a/, /e/, and /o/). Among the high vowels, she argues that "/u/ is more readily unvoiced than /i/" based on the results of her experiments, in which /u/ was devoiced at a slower rate than /i/ in the same environment (e.g., /kiʃi/ 'shore' and /kuʃi/ 'comb'). However, Yuen (1997) reports otherwise: he found that /i/ is more likely to be deleted/devoiced than /u/[5]. On the other hand, Maekawa (1983) found no difference in the devoicing rate of /i/ and /u/ in his analysis of a female TV broadcaster's speech. Imai (1997) also found no difference in the devoicing rate between the high vowels.

[5] Yuen (1997), and other phoneticians, uses a phonetic transcription ([i] and [ω]), but I will use a phonemic transcription for the sake of simplicity.

2.2.3 Accent

Accent is another well-studied factor of Japanese vowel devoicing. It has been argued that a high vowel between voiceless consonants either does not undergo devoicing when it bears an accent, or that the accent is shifted to either the preceding or the following vowel to allow devoicing (Sakuma 1929, Han 1962, Sakurai 1985, Maekawa 1988, Sugito and Hirose 1988, Nagano-Madsen 1995). However, more recent studies show that even an accented vowel can undergo devoicing, particularly among younger speakers (Sugito 1982, Sakurai 1985, Maekawa 1988, Sugito and Hirose 1988, Kondo 1993, Nagano-Madsen 1995, Imai 1997, Tsuchida 1997).

Han (1962) claims that a high vowel between voiceless consonants is generally not devoiced when it has a high pitch but is devoiced when it has a low pitch. However, Maekawa (1988) found no effect of pitch height (i.e., high or low) on vowel devoicing in his analysis of a female TV broadcaster's speech. Han studied minimal pairs with a pitch height difference (e.g., /kī*k*ukoto/ 'to listen' LHHL and /kík*u*koto/ 'with Kikuko' HLLL, where L indicates a low pitch, H indicates a high pitch, and the italicized letter indicates a devoiced vowel). She claims that /i/ in the former and /u/ in the latter are devoiced because they have a low pitch, which is not entirely supported because it is possible that other factors may be playing a role in the former (e.g., the word-initial position or the first syllable in a sequence of devoiceable vowels, which is discussed in 2.2.4 below).

Although these two studies used the pitch height of the mora, a more common description of the interaction between pitch accent and vowel devoicing

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is that vowel devoicing is blocked in an accented mora, which has a high pitch and is followed by a low pitched mora (Sakurai 1985, Sugito 1988, Nagano-Madsen 1994).

Sugito and Hirose (1988) state that, in the Tokyo dialect, accent is usually shifted to the following vowel if the vowel is devoiced, but in some cases there is no accent shift and the high vowel is still devoiced. They claim that accent shift never happens in the Kinki dialect, thus producing accented, devoiced vowels. They found that "it is the following descending tones that make preceding devoiced vowels heard as accented" (21). Nagano-Madsen (1995) found, in her acoustic study of a female speaker of Standard Japanese using frame sentences, that devoicing was strongly demoted before [ʃ], [ç], and [ɸ] when the vowel was accented. This agrees with the description in the *Japanese Pronunciation and Accent Dictionary* (NHK 1985) that devoicing is inhibited before /h/ when the vowel is accented. However, Nagano-Madsen (1995) states that "recent works using longer words and a sentence database found no overriding influence of accent in preventing devoicing" (566) and "due to the restricted and uncontrolled corpus, these studies [Kondo 1993 and Nagano-Madsen 1994] did not reveal much clarity as to the relationship between accentuation and segmental contexts" (566).

However, Sakurai (1985) states that the effect of accent on vowel devoicing is weaker among younger generations. Tsuchida (1997) also argues that there is no effect of accent on vowel devoicing in native Japanese words among younger speakers, but older speakers still maintain this restriction.

However, in loan words, accent does have a strong effect, even among younger speakers, and she attributes this difference to the difference in the representation of accent in native words and loan words: native words have an underlying accent linked to a vowel, but loan words have a floating accent, which is linked to a vowel by a phonological rule, which therefore avoids accented, devoiced vowels. (Refer to Tsuchida 1997 for more details.)

On the other hand, Yuen (1997) still found that unaccented vowels are more likely to be devoiced than accented ones. Therefore, the effect of accent is not very clear.

However, a high vowel before a pause and after a voiceless consonant is devoiced only when the vowel has a low pitch (Martin 1952, NHK 1985), and there is no study that has found contradictory results. Therefore, accent would seem to have a strong effect in this environment; i.e., a high vowel before a pause.

In summary, it seems that the effect of accent is weak particularly among younger generations. However, having a high pitch in the word-final mora prevents devoicing, regardless of age.

2.2.4 Morpheme boundaries

It is also argued that morpheme boundaries have a blocking effect on vowel devoicing when combined with other factors (Sakurai 1985, Vance 1987, 1992, Kondo 1997, Tsuchida 1997). Sakurai (1985) says that when a devoiceable vowel is followed by /s/, /h/, or /ʃ/, and there is a morpheme

boundary after it, it is less likely to devoice (e.g. /booeki̥#suijun/ 'a trade standard' [underlining indicates a non-devoiced vowel and '#' marks a compound word boundary]). Other studies argue that, if it is the only devoiceable vowel, a high vowel may be devoiced at a word boundary, but in a consecutive devoicing environment, the vowel at a morpheme (or word) boundary remains voiced (Vance 1987, 1992, Kondo 1997, Tsuchida 1997).

2.2.5 Consecutive devoicing

When there is more than one devoiceable vowel in a row, previous research suggests that not all of the vowels are likely to be devoiced (Sakuma 1929, Martin 1952, Han 1962, Kawakami 1977, Maekawa 1988, Tsuchida 1997), avoiding consecutive devoicing, as in /ki̥ʃi̥tsu/ 'temperament' (LHH pitch accent pattern). The first high front vowel /i/ is devoiced, but the second one is not.

Han (1962) says that "the unvoicing of vowels in two successive syllables is rare, and the unvoicing of three successive vowels does not occur" (91). On the other hand, Kawakami (1977) says that when there are many devoiceable vowels, sometimes those vowels are voiced. His example is as follows.

(6) /ʃiʃutsu/ 'expenses' → [ʃi̥ʃɯ̥tsɯ], [ʃʃɯ̥tsɯ], [ʃi̥ʃɯtsɯ], [ʃʃɯtsɯ], and [ʃiʃɯ̥tsɯ]

Kawakami (1977) claims there are five possible realizations of /ʃiʃutsu/; one in which the first two vowels are devoiced ([ʃi̥ʃɯ̥tsɯ]), one in which the first

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vowel is deleted and the second vowel is devoiced ([ʃʃɯ̥tsɯ]), one in which the first vowel is devoiced and the second vowel is voiced ([ʃi̥ʃɯtsɯ]), one in which the first vowel is deleted and the second vowel is voiced ([ʃʃɯtsɯ]), and one in which the first vowel is voiced and the second vowel is devoiced ([ʃiʃɯ̥tsɯ]). He claims that all the vowels are not devoiced because, if they were, there would be too many voiceless consonants in a row, which might cause confusion between similar words, such as /ʃiʃamo/ → [ʃʃamo] (a kind of fish) and [ʃamo] ('a fighting cock'). This seems to indicate that there is considerable variation in the realization of a word with consecutive devoicing possibilities.

Sakuma (1929) states that devoicing in two consecutive syllables does occur, as in (7).

(7)	[k(ɯ̥)tʃi̥saki]	'muzzle'
	[ki̥kɯ̥tʃi]	person's last name

However, he also says that when a speaker is pronouncing the word slowly, it is usually only the first vowel that is devoiced ([kɯ̥tʃisaki] and [ki̥kɯtʃi]).

More recent studies seem to agree that the devoicing of consecutive syllables is avoided. Maekawa (1988) reports the results of his study conducted in the Tottori prefecture and says that, for the word /sukikirai/ ('likes and dislikes'), there were three different realizations; three speakers pronounced it as [sɯkikirai], nineteen as [sɯ̥kikirai], and four as [sɯ̥ki̥kirai]. He says that there are

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two interpretations of this; one is that the first syllable in the devoiceable sequence is more likely to devoice, and the other is that the vowel following a fricative is more likely to devoice.

Avoidance of consecutive devoicing has been mentioned and studied by many researchers, but the system of avoidance is still not clear. There are several factors that control the devoicing pattern in consecutive devoicing environments. (Refer to Tsuchida [1997] for a more thorough review.) Below is a list of the restrictions in the patterning of devoicing in a consecutive devoicing environment derived from previous studies.

1. An accented vowel resists devoicing (Martin 1952, Han 1962), e.g., [kúʃ̥ikumo] 'strangely.'
2. The vowel in a word-initial mora is more likely to devoice (Martin 1952, Yuen 1997), e.g., [ʃ̥ikitsuméru] 'spread completely.'
3. A preceding fricative promotes devoicing (Han 1962), e.g., [sekiʃ̥itsu] 'room made of rock.'
4. A high vowel preceding a word boundary resists devoicing (Vance 1987, 1992, Kondo 1997), e.g., [kankaku#kɨ̥kan] 'sense organ.'

Tsuchida (1997) provides a phonological analysis of the interaction of these factors in the framework of Optimality Theory. She posits a set of constraints, which are responsible for the devoicing pattern. However, Tsuchida concludes as follows.

> [W]hen there are more than two devoiceable vowels in consecutive syllables, the locus of devoicing is determined in two steps: first, either the initial or second vowel in the sequence is selected based on the ranked constraints, then the voicing of the following vowels is determined in an alternating pattern. (272)

Even though she can account for the devoicing pattern of shorter consecutive devoicing environments (up to two) using her ranked constraints, she cannot account for the patterns in a longer environment (with three devoiceable vowels) with only her constraints.

2.2.6 Summary

In this subsection, various linguistic factors that have been argued to have an effect on vowel devoicing were discussed. Most studies agree that a preceding fricative and/or a following stop promotes devoicing. However, Yuen's (1997) claim that there is an interaction between the preceding and the following consonants is interesting because researchers disagree on which side of the vowel context has a stronger effect on devoicing. The effect of a pause is different depending on the position: a sentence-final pause promotes devoicing, but a sentence-internal pause demotes it. Vowel identity does not seem to be a factor, but this is still controversial. Accent does not have an effect among younger generations but has an effect among older generations. In consecutive devoicing environments, there seems to be a set of constraints involved: an accented vowel and a vowel at a word boundary resist devoicing, but the first vowel in a sequence of devoiceable vowels and a vowel with a preceding

fricative are more likely to devoice. A high vowel in a devoicing environment at a morpheme boundary also resists devoicing, particularly in a consecutive devoicing environment and before /h/.

2.3 Social factors

Most studies of vowel devoicing in Japanese are phonetic ones, which try to discover the articulatory mechanisms of the phenomenon, and there are only a few studies that investigate the social aspects of this phenomenon. Maekawa (1988) mentions the "standardness" of vowel devoicing in Japanese. It is considered "standard" in both production and perception: 1) there are some fixed patterns for devoicing where more than two vowels are devoiceable, and 2) there are cases in which, if a vowel is not devoiced, it sounds strange (at least to speakers of standard or devoicing varieties). Maekawa (1988) also mentions the possible influence of age, sex and speech style but says there is almost no research in the field that has focused on these social factors; he suggests that a relatively well-studied social factor concerning vowel devoicing is regional differences, which have been studied by Japanese dialectologists (language geographers and comparative dialectologists).

In this section, I will discuss the social factors that are argued to affect vowel devoicing in Japanese, namely, region, age, sex, speech style, and social class (socioeconomic status).

2.3.1 Region

A relatively well-studied social factor of Japanese vowel devoicing is region. Since Kindaichi 1954 (cited in Maekawa 1988), Japanese dialectologists have agreed that there is regional variation in vowel devoicing in Japanese. Mase 1977 (cited in Maekawa 1988) divides the dialects in Japan into eastern and western dialects and considers vowel devoicing as an important factor in describing the phonological characteristics of them, saying that eastern Japanese dialects are "consonant-prominent," and western dialects are "vowel-prominent." NHK (1985) provides a map of Japan and divides it into two regions in terms of devoicing: "more noticeable" and "less noticeable." Roughly, eastern and southern Japan are marked as dialects of more noticeable devoicing and western and northern Japan as dialects of less noticeable devoicing. However, these are all based on impressionistic judgments.

Sugito (1988) conducted an acoustic study of the speech of 10 males in their 30s to 50s from eight different cities in Japan, namely, Tokyo, Sendai, Nagoya, Osaka, Kochi, Okayama, Kumamoto, and Naha, using a reading passage. She found that there is a variation in the frequency of vowel devoicing among the different cities. Her results confirmed that cities in the eastern and southern parts of Japan (Tokyo, Sendai, Kumamoto, and Naha) have higher percentages of devoicing (over 50%), and western cities (Osaka, Okayama, and Kochi) have lower percentages (less than 35%), except Nagoya, which had the highest percentage (almost 70%) of all. She attributes this to the Nagoya area's diversity and suggests that we need to investigate that area in more detail. Also,

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Nagoya has a significantly higher devoicing rate than that of Tokyo in vowels before a sentence-internal pause (e.g., before a comma) as in *ooku* '(it is) a lot, and' (the connective form of *ooi* '(it is) a lot'). She suggests that this might be related to the Tokyo speakers' awareness of "standard" and that that factor motivates them to speak clearly, i.e., to avoid devoicing in certain environments.

Although Nagoya seems to be an exceptional case, Sugito's (1988) results seem to confirm the general description of the regional differences, which is that eastern and southern Japan have more devoicing and western and northern Japan less devoicing.

Except for Sugito (1988), there is no study that statistically shows regional differences in the frequency of vowel devoicing, because the earlier studies are based on impressionistic judgments. There are, however, a few studies that investigated the frequency of vowel devoicing in other regions, such as Osaka. Tahara, et.al. (1998, cited in Morris 2003) asked twenty people from Osaka, both male and female, and in different age groups, to read a set of sentences. There are two sentences in which the high vowels /i/ and /u/ occur between voiceless consonants in an unaccented syllable, which are not at a word boundary or in a consecutive devoicing environment. Out of twenty respondents, sixteen or seventeen devoiced those vowels, which gives us a devoicing rate of 82.5%. This is comparable to the devoicing rate by Tokyo speakers from Sugito's (1988) study. Based mostly on this high percentage of devoicing by Osaka speakers in the most favored environments for devoicing, Morris (2003) suggests that the devoicing rate in Tokyo and Osaka (or Kinki) dialects may not be very different in

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an environment in which no other factors interact. However, the devoicing environments of the vowels taken from Tahara et.al.'s study were very limited; only two vowels were used.

Thus, there is no study that consistently investigated the regional differences in the frequency of vowel devoicing taking into consideration the various factors that affect devoicing. Sugito (1988) compared the overall devoicing rate from difference dialects, but she did not take into account the effect of accents, consecutive devoicing environments, and word boundaries. More study is necessary in this area before we can find a pattern of regional differences in devoicing.

However, Maekawa (1988) says that although regional difference in Japanese vowel devoicing is evident, the details of the differences cannot simply be explained by the devoicing rate in /...CVC.../ environments (C indicates a voiceless consonant and V indicates a vowel). He suggests that regional difference in vowel devoicing should be understood as forming a continuum rather than being categorical. Moving from east to west, one finds different consonant articulation, such as affrication of [k], and devoicing before a voiced consonant, which ultimately reaches the point where a high vowel between voiced consonants is deleted, resulting in the gemination of a voiced consonant, as in /kaji##da/ → /kad##da/ 'there is a fire.' Thus, in order to understand the regional differences and draw dialect lines of more or less devoicing, one needs to investigate various consonant environments and the distribution of the overall

devoicing rate from different regions, considering age difference and errors caused by different methods.

2.3.2 Age

Age differences in vowel devoicing have been assumed, particularly in association with accent; namely, older generations do not devoice accented vowels, but younger generations do (NHK 1985, Sakurai 1985, Tsuchida 1997). However, no sources are cited in those statements, and there is no systematic and extensive study that focuses on age differences, so I must regard these comments as impressionistic or based on anecdotal or very limited data.

Mineta (1988, cited in Maekawa 1988) reports an age difference in vowel devoicing in her study conducted in a village in the Aichi prefecture. According to her, younger generations devoiced 82.3% of the high vowels between voiceless consonants and older generations devoiced 61.9%. However, this difference is likely due to the difference in the devoicing rate of accented vowels: the older generation's devoicing rate (about 30%) was only half that of the younger generation's in that context. Sugito (1988) also reports an age difference in the devoicing rate in Osaka with more devoicing among younger generations, which she interprets as a change. However, she does not mention the effect of accent in the age difference, implying that younger generations devoice more in general.

On the other hand, Maekawa (1988) says that, in his study conducted in a town in the Tottori prefecture, he could not see any strong age effect in vowel devoicing. It was true that younger generations devoiced more than older

generations, but the difference was slight[6], and his conclusion was not based on any statistical analysis.

In general, there seems to be an age difference in the devoicing of accented vowels. However, the evidence for age difference in general is weaker because we have different results from different dialects, i.e. age difference is reported in the Osaka and Aichi dialects, but not in the Tottori dialect. This seems to show that there may be an interaction between age difference and region. It should be noted that there has been no study investigating age differences in vowel devoicing among Tokyo dialect speakers.

2.3.3 Sex and speech style

Sex and speech style are two of the most commonly studied factors of language variation. However, I am aware of only one study that investigated the effect of these factors on Japanese vowel devoicing (Yuen 1997)[7].

Yuen (1997) hypothesized that there would be a sex difference in vowel devoicing because female speech and male speech are very different in Japanese. He further hypothesized that male speakers would devoice vowels more than female speakers do because female speech is more polite than male speech; therefore, he claims, female speech is slower "for producing clearer and more audible speech" (Yuen 1997: 11). He suggests that this leads to a longer duration of vowels in female speech than male speech and that vowel devoicing

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[6] According to the chart Maekawa provides, [ʃi] was constantly devoiced more frequently than [ki] in all generations, indicating the effect of the preceding consonant.

[7] Imai (1997) included sex difference but not style difference.

would be less likely to occur in female speech than in male speech, assuming a negative correlation between vowel duration and devoicing.

Yuen used three different speech styles: reading sentences using a frame sentence, reading a passage from Japanese fiction, and conversation (answering questions). His subjects were 9 speakers of the Tokyo dialect, who were raised in Tokyo and lived there at least 15 years; there were 4 males and 5 females, all between 20 and 30 years of age. He found that, as the degree of formality increases, the speech rate decreases and the vowel length increases; therefore, devoicing decreases. This correlation of voicing (or non-devoicing), speech rates, and vowel length was significant ($p=0.05$). He also found that the vowel length of males is indeed shorter than that of females, that males have faster speech rates than females, and that males devoice more than females. However, speech style alone statistically has a stronger influence than sex. Actually, speech style was the most significant of all the linguistic and social factors he investigated, and sex was the second. The complete ranking of his factors, both linguistic and social, in terms of the relative importance is as follows: Speech Style > Sex > Word Position > Accent > Following Consonant > Preceding Consonant > Vowel Quality. Yuen used an ANOVA post-hoc test, an ANOVA factorial test and a correlation Z test for his statistical analysis.

Imai (1997) included sex as one of the factors expected to affect vowel devoicing and found that males devoiced more than females, but this difference was not statistically significant because of the small number of respondents; i.e. only four in this study.

Yuen (1997) attributed the sex difference in Japanese vowel devoicing to females' greater politeness and tendency to speak slower, especially in formal style. However, I would interpret this as an indication of standardness or appropriateness because, if we look at the interaction chart of voicing means and speech style for males and females (Yuen 1997: 28, Figure 11), the difference between males and females is about twice as large in the formal reading style than in the conversation style and the casual reading style. If women do something a lot more in more formal style, in which they pay most attention to their speech, they may be doing something they consider to be standard, or prestigious. Most sociolinguistic research suggests that women are more prestige-conscious (Wolfram and Schilling-Estes 1998: 188-192).

2.3.4 Social Class

Although social class is one of the major social factors of language variation, there has been no study that investigating social class differences in Japanese vowel devoicing. Actually, no language variation studies in Japanese have investigated this factor, although some researchers have used the *yamanote/shitamachi* distinction. *Yamanote* ('uptown') is associated with an image of white-collar workers and greater prestige, while *shitamachi* ('downtown') is usually associated with an image of blue-collar workers, merchants, and lower prestige. Hibiya (1995) used social class as a variable in her study of the variation of /ŋ/, but she used this distinction between *yamanote* and *shitamachi*. However, this distinction may not be valid; it is descended from the historical

regional separation of two social classes and not based on the actual social status of the people who currently live there. Besides, people frequently move within Tokyo and also from other areas of Japan to Tokyo.

Social class is used extensively in many sociolinguistic studies; in the U.S., for example, occupation, education, income, type of housing, and neighborhood are used to calculate the socioeconomic status of respondents and classify them into such different social groups as Lower, Working (Lower/Upper), Middle (Lower/Upper), and Upper classes, based on scores assigned to these various subcategories. However, this method has not been used in the language variation studies in Japan.

There are several social classifications systems in Japan but none of them is agreed upon by Japanese sociologists (Kosaka 1994a). The Social Stratification and Social Mobility (SSM) survey, which started in 1955 and is conducted every 10 years, uses the categories below (from Table 3-8; Kosaka 1994a: 47).

1. Professional
2. Managerial
3. Clerical
4. Sales
5. Skilled
6. Semi-skilled
7. Unskilled
8. Farmer

However, the above classification does not take into account the size of firms and job status, which obviously influence socioeconomic status.

Seiyama (1994) uses the terms "non-manual" for 1 to 4 in SSM categories and "manual" for 5 to 7, and further divides the people within these new categories into "upper" and "lower" non-manual and manual in order to compare the Japanese data with U.S. data. Farmers, including people engaged in fishing and forestry, form a category by themselves, and almost all of them are self-employed. Seiyama also uses the terms "white-collar" and "blue-collar," which correspond to "non-manual" and "manual," respectively. He also points out that the salaried vs. self-employed distinction is important in Japan because of a large proportion of self-employed workers. Seiyama's new classification, partly based on social mobility, is as follows.

1. Salaried white-collar
2. Self-employed white-collar
3. Salaried blue-collar
4. Self-employed blue-collar
5. Farmer

Kosaka (1994a) introduces another ("neo-Marxist") scheme, but it does not provide a continuous scale.

1. Capitalist Class (managers, self-employed and family workers with more than four employees)

2. New Middle Class (full-time or part-time managerial, professional, and full-time clerical)

3. Working Class (Others)

4. Old Middle Class (self-employed and family workers with fewer than four employees)

Thus, sociologists use different classifications for different purposes. However, they all seem to draw a line between white-collar, non-manual, professional, managerial, clerical and sales people on the one hand, and blue-collar, manual, skilled, semi-skilled, and unskilled workers on the other. I interpret this, roughly, as a distinction between Middle and Working Class. In this sense, their classification is not so different from the ones used in the U.S.

2.3.5 *Summary*

Dialectologists (i.e. Kindaichi and Mase) agree that there is regional difference in the frequency of vowel devoicing, and a general description is that eastern and southern Japan have more devoicing and western and northern Japan less devoicing. However, we need more study in this area because of the lack of extensive studies that focus on regional differences. There seems to be an age difference in the devoicing of accented vowels; younger generations devoice more and older generations less, but age difference in general needs more extensive study. As for sex and speech style differences, females tend to devoice less than males, and vowel devoicing is more likely to occur in casual

style. Finally, there are no studies of the effect of social class difference on Japanese vowel devoicing. In general, research on the effects of social factors on vowel devoicing is needed.

CHAPTER 3

METHODOLOGY

In this chapter, I will discuss the variables (factors) used in the present study, both linguistic and non-linguistic (3.1), coding of those variables (3.1), data collection (3.2), and the data handling procedures (3.3).

3.1 Variables

Two kinds of variables are used in the present study: linguistic and non-linguistic (social) ones:

<Linguistic variables>

1. Vowel identity
2. Preceding consonant identity
3. Following consonant identity
4. Morpheme boundary type
5. Pitch accent pattern
6. Consecutive devoicing environment

<Social variables>

1. Age
2. Sex
3. Social class
4. Speech style

These linguistic variables and stylistic varieties were guaranteed to occur by being incorporated into the word list and a reading passage in the data collection phase of the project; the other social variables were realized through respondent selection.

Each variable was coded in an Excel file row for each occurrence of the dependent variable — a voiced or devoiced vowel. I will discuss variable selection, coding, and expected results in the following subsections.

3.1.1. Linguistic variables

3.1.1.1 Vowel identity

Vowel identity is included to see if there is any difference in the rate of vowel devoicing among the five vowels, particularly between the two high vowels, /i/ and /u/. Even though some researchers argue there is a difference between the two (e.g., Han 1962), other studies, particularly sociolinguistic ones, did not find any (e.g., Maekawa 1983). I expect to find no difference in the frequency of vowel devoicing for /i/ and /u/, and, although it is clear that the non-high vowels (/e/, /o/ and /a/) will be much less frequently devoiced, I have no prediction about any possible difference in the rate among them.

3.1.1.2 Consonant identity

The type of consonant is important in vowel devoicing in Japanese; therefore, I identify both preceding and following consonants as variables. I

coded the exact identity of the preceding and following consonants instead of combining them according to place and/or manner of articulation. By coding for exact identity, it will be easy to study groups of consonants based on place and manner of articulation or other factors later, but initial coding by groups would presuppose similarities.

The numeric values for the preceding and following consonants used in my coding scheme are as follows.

1 = [ʃ]
2 = [s]
3 = [tʃ]
4 = [ts]
5 = [ç] (palatal fricative)
6 = [ɸ] (bilabial fricative)
7 = [h]
8 = [t]
9 = [k]
10 = [p]
11 = pause (Only for the following environment.)

Voiced consonants were coded as themselves (e.g., b, d, g), not as numbers.

I coded all the vowels between voiceless consonants, and also coded the high vowels after a voiceless consonant and before a voiced consonant. In Japanese the preceding consonant inventory is limited before /i/ and /u/ because of the allophonic alternation of /t/, /s/, and /h/ (see Chapter 1). /t/ becomes [tʃ]

before /i/, and [ts] before /u/. Similarly, /h/ becomes [ç] (palatal fricative) before /i/, and [ɸ] (bilabial fricative) before /u/. Finally, /s/ becomes [ʃ] before /i/, but remains [s] before /u/. Thus, [t] never occurs before /i/ or /u/ except in loanwords, [s] never occurs before /i/, and [h] never occurs before a high vowel.

My hypothesis is that a preceding fricative will have a greater influence on the application of vowel devoicing than a stop or an affricate, and a following stop more than a fricative or an affricate. It is also expected that devoicing is demoted before any allophone of /h/, and between two fricatives.

Another hypothesis is that these preferences, and perhaps all the others listed here, will show a gradient effect according to speech style. Even if devoicing before an allophone of /h/ and between two fricatives is prohibited in phonology, phonetic devoicing occurs, particularly in conversation, which is usually a more allegro speech style than that found in word lists and reading passages. My prediction is that devoicing occurs more frequently in more casual styles (i.e. word list < reading passage < conversation).

3.1.1.3 Morpheme boundary type

Researchers (e.g. Sakurai 1985, Vance 1987) agree that a morpheme boundary has an effect on vowel devoicing in Japanese: vowel devoicing is avoided at a morpheme boundary, particularly in a consecutive devoicing environment (Sakurai 1985, Vance 1987, 1992, Kondo 1997, Tsuchida 1997). However, we do not know if the avoidance of devoicing depends on the type of

morpheme boundaries. Therefore, morpheme boundary type is included in the present study, and different types of boundaries were included in the word list and reading passage. Morpheme boundaries are coded depending on their status as a bound or free morpheme. The actual coding used is as follows.

1 = no boundary (morpheme internal)

2 = pause (e.g. word-final position)

3 = bound morpheme boundary (inflectional and derivational morphemes, e.g., *oishi+katta* 'it was tasty'; and bound content morphemes, as in Sino-Japanese compounds: e.g. *shitsu+ren* 'lost love')

4 = compound word boundary: e.g., *booeki#suijun* 'a trade standard'

5 = word boundary

3.1.1.4 Pitch accent pattern

Pitch accent pattern is included to see if there is any effect on vowel devoicing, and if there is a change among different age groups since it has been reported that younger generations tend to devoice even accented vowels, which older generations tend not to devoice (Sugito 1982, Sakurai 1985, Maekawa 1988, Sugito and Hirose 1988, Kondo 1993 [cited in Tsuchida 1997], Nagano-Madsen 1995, Imai 1997, Tsuchida 1997).

Most of the research on devoicing has used the distinction between accented and unaccented vowels, but I use pitch accent pattern because the accented/unaccented distinction is contained in this representation, and, if there

is even a greater sensitivity than to just the accented/unaccented distinction, this coding may be able to capture it.

Pitch accent pattern is coded to reflect all possible patterns for the preceding and following mora combinations as shown below. Each letter represents a tone-bearing unit (=mora) or a pause (#), and the middle letter is the target vowel.

1 = LLL	7 = HHL	13 = #L#
2 = LLH	8 = HHH	14 = #H#
3 = HLL	9 = #LL	15 = LL#
4 = HLH	10 = #LH	16 = LH#
5 = LHL	11 = #HL	17 = HL#
6 = LHH	12 = #HH	18 = HH#

It is expected that older generations devoice less in pitch accent patterns 5, 7, and 11 than younger generations because these are all cases of accented vowels. It is also expected that devoicing is less likely to occur in pitch accent patterns 14, 16, and 18 because the vowel is before a pause and high-pitched (refer to 2.2.3).

3.1.1.5 Consecutive devoicing environment

Consecutive devoicing is usually avoided, as discussed in 2.2.5; however, consecutive devoicing may occur (Maekawa 1988, Imai 1997). All instances of the high vowels /i/ and /u/ and any other vowels that were actually devoiced were

coded to see whether or not they were in a typical devoicing environment (between voiceless consonants or after a voiceless consonant and before a pause), whether or not the preceding vowel was in a typical devoicing environment, and whether they (or their preceding vowels) were or were not actually devoiced. The coding is as follows.

0 = the vowel is not in a consecutive devoicing environment (i.e., the previous vowel is not in a typical devoicing environment.)

1 = the previous vowel is in a typical devoicing environment, but it is not devoiced.

2 = the previous vowel is in a typical devoicing environment, and it is devoiced.

x = the vowel is not in a typical devoicing environment

For example, in a phrase /i+shiki#fu+mee##no##kyoo+aku+han/ ('a brutal criminal who is unconscious', where '+' indicates a bound morpheme boundary, '#' a compound word boundary, and '##' a word boundary), the second /i/ is coded as '0' because the previous vowel is not in a devoicing environment ('#i-sh'). The third /i/, however, would be coded as either '1' or '2' depending on the voicing of the previous vowel, which is in a devoicing environment — 'shik'. If the previous vowel was devoiced, the third 'i' would be coded as '2'; if the previous vowel was not devoiced, it would be coded as '1.' The first /u/ is coded as 'x' because, although it is preceded by [f], a voiceless consonant, it is followed by [m], a voiced consonant; therefore it is not in a typical devoicing environment. Finally, the second /u/ is coded as '0' because it is preceded by [k] and followed

by [h], therefore in a devoicing environment, but the previous vowel is not in a devoicing environment — 'o-ak'.

My hypothesis is that consecutive devoicing is more likely to occur as the speech style becomes more casual because phonetic devoicing is more likely to occur in more casual, faster speech.

3.1.2 Social variables

Vowel devoicing in Japanese, between voiceless consonants and in a low-pitched syllable, is considered standard in Tokyo dialect (cf. *Japanese Pronunciation and Accent Dictionary*). Maekawa (1988) states that it is considered standard because there are some fixed patterns in consecutive devoicing environments and that if someone does not devoice the final vowel in a sentence-final polite copula, as in /soo##desu/ ('It is so.'), it sounds strange to the ears of Tokyo speakers. The first reason appeals to prescriptive authority, and the second presupposes that Tokyo speakers are speakers of the standard variety and that anything which "sounds strange" to them is not.

The findings in Yuen (1997) suggest that vowel devoicing in Japanese has social meaning, since he found sex and speech style differences. However, it is male speakers who devoiced more, not female speakers, in his study, which might suggest that this feature is nonstandard, because women are reported, in many sociolinguistic studies, to use more standard features than men. Furthermore, female speakers' voicing mean was much higher than that of male speakers' in the most formal style, formal reading style, in Yuen (1997). This also

seems to suggest that devoicing is a nonstandard feature because females devoice much less in the most formal style than males do, and females are known to use more prestigious, or standard forms, in more formal styles.

The style differences also suggest that devoicing behaves like a nonstandard feature because more devoicing was found in more casual styles in Yuen (1997). He attributed these differences to women's being more polite than men by speaking slower and more clearly, therefore resulting in less devoicing.

If we had only Yuen's (1997) results, we would have thought that Japanese vowel devoicing is just a fast speech phenomenon. However, considering its status as a standard Tokyo feature, according to the general perception of Japanese speakers (cf. Maekawa 1988) and to prescriptive authority (i.e. NHK 1985), we must conclude that it has deeper social meaning. If it does have such meaning, it is an interesting phenomenon since articulatory studies show that it is an unconsciously monitored process, one in which speakers make an (unconscious) effort to produce a devoiced vowel and the neighboring voiceless consonant with a single glottal opening (Sawashima 1971 [cited in Maekawa 1988], Tsuchida 1997).

Another piece of support for the position that devoicing is nonstandard exists in the report that younger speakers tend to devoice even accented vowels, whereas older speakers tend not to. This, however, might also suggest that there may be language change going on among younger speakers, or it might even reflect an age grading differentiation regarding vowel devoicing in Japanese.

Neither of these hypotheses, however, has been sufficiently studied to allow us to suggest with any certainty that the feature is standard or nonstandard.

From these previous observations and studies, it is possible to suspect that there are some social meanings attached to Japanese vowel devoicing, but there has been no study that looked at this phenomenon in a language variation framework.

In order to investigate the social meaning of this phenomenon more thoroughly in the framework of variationist sociolinguistics, I included four common social factors: age, sex, social class, and speech style, although, as I have noted above, speech style will also be an important consideration in determining the influence of some linguistic factors.

3.1.2.1 Age

Three age groups are used in this study: Younger, Middle, and Older. At first, real age was coded, and the devoicing percentage was obtained for each respondent. However, no grouping tendency could be derived from these percentages, and the respondents were grouped together using thirty and sixty years of age as the boundaries. Respondents younger than 31 are coded as 'Y,' those over 30 and younger than 61 as 'M,' and those over 60 as 'O.' Table 3.1 shows the age groups and number of respondents for each sex.

Table 3.1: Age Groups

Age Group	Male	Female	Total
Younger (15-30)	8	7	15
Middle (31-60)	7	7	14
Older (61-90)	6	7	13
Total	21	21	42

If devoicing is a feature changing in Tokyo (i.e. increasing), one would expect Younger respondents to generally devoice more than Older respondents, and Middle respondents to fall somewhere in between. If devoicing is a stable variable, however, one would expect a typically age-graded pattern in which the Younger and Older groups would devoice most, if it is a nonstandard form (Chambers and Trudgill 1980).

3.1.2.2 Sex

Sex is included because the difference between men and women in vowel devoicing in Japanese has been reported (Yuen 1997), and sex has been shown to be an extremely important variable in numerous Japanese sociolinguistic research (Haig 1990, Ide and McGloin 1990, Okamoto 1995, Ide 1997, Ide and Yoshida 1999). In the present study there are 21 respondents in each sex group.

It is difficult to predict whether males or females will devoice most. Since devoicing is considered a standard (NHK 1985, Maekawa 1988), one might expect more frequent female devoicing, in keeping with widely-observed sex-related practice (Wolfram 1969; Labov 1972; Wolfram and Fasold 1974; Trudgill

1983), but if devoicing is associated with rapid, casual speech, then males might dominate.

3.1.2.3 Social class

Social class is included in the present study because it has been shown to be an important factor in sociolinguistic studies (e.g. Labov 1966, Trudgill 1974, Wolfram and Fasold 1974), although there is no study of Japanese vowel devoicing that uses social class as a variable.

I divided my respondents into three groups: Upper Middle, Lower Middle, and Working. Since no previous sociolinguistic studies on Japanese use social class (or socioeconomic status) as a variable, I basically adopted the criteria commonly used in sociolinguistic studies in the U.S. (Labov 1966; Shuy, Wolfram, and Riley 1968; among others, e.g. Warner Index of Social Status 1960), using socioeconomic scores adapted to the Japanese urban Tokyo environment (cf. Kosaka 1994b)

Each respondent was assigned a socioeconomic score according to their occupation, education level, and neighborhood.

Occupation: There are five scores for occupation as follows:

1 = blue-collar, heavy physical labor; such as plumbers

2 = blue-collar, light-physical labor; such as daycare workers and noodle shop workers

3 = white-collar, lower prestige; such as employees of a mid-size to big company, presidents of a small company, and owners of a small store

4 = white-collar, higher prestige; such as managerial at a bigger company, engineers, and university instructors/professors

5 = most prestigious; such as doctors, lawyers, and presidents of big corporations

If the respondent is a student, their parents' occupation was used to determine their score.

Education: There are also five scores for education level as follows:

1 = high school education or below
2 = vocational college/technical school
3 = junior college
4 = university
5 = graduate school

If the respondent is a middle school student, I assigned the score that they are most likely to get in the future. For example, if the respondent is a middle school student and their parent is a doctor or an architect, I assigned '4' to them because it is very likely that they will receive university education.

These two scores of occupation and education were multiplied by two and combined with the score of neighborhood, based on Warner (1960)'s estimates of their relative importance in determining status, although I gave weight to occupation and education, due to my assumption that education may have greater prestige in Japanese society.

Neighborhood: The scores for neighborhoods were derived from informal discussions I had with friends who live in Tokyo. I used the following 5 categories:

1 = 'not good'
2 = 'so-so'
3 = 'adequate'
4 = 'good'
5 = 'very good'

As a result of this scale, two of my respondent neighborhoods are classified as 1, eight as 2, seven as 3, ten as 4, and three as 5 (see Appendix C).

Categorization: These three scores (occupation, education, and neighborhood) were combined resulting in a range of 5 to 25 (see Appendix D), and the respondents' scores ranged from 5 to 23. First, these raw numbers were entered into the Excel coding sheets together with the coding for other variables, and devoicing percentages were obtained for each respondent. As it was with age, no natural grouping of the respondents or correlation with devoicing was found. Therefore, groups were made so that there are about the same number of respondents in each group. As a result, those respondents whose score falls between 6 and 11 were grouped as Working, those between 12 and 17 as Lower Middle, and those between 18 and 23 as Upper Middle. An investigation of the occupation of those who fall into these groups makes this grouping appear to be

a reasonable one. Table 3.2 shows social class and number of respondents for each sex.

Table 3.2: Social Classes

Social Class	Male	Female	Total
Working (6-11)	7	7	14
Lower Middle (12-17)	7	9	16
Upper Middle (18-23)	7	5	12
Total	21	21	42

3.1.2.4 Speech style

I used three speech styles in this study: Word list (see Appendix A), Reading passage (See Appendix B), and Conversation (see Appendix E for a sample conversational transcription). These styles form a continuum of formality, conversational style being the least formal and word list style being the most formal. The more formal the style is, the more attention speakers pay to their speech (Labov 1966) and such attention usually results in a greater incidence of formal or prestigious forms. Yuen (1997) found that speech style is the most significant factor in vowel devoicing in Japanese. I expect to find a similar result, namely, that devoicing is promoted as the speech style becomes more casual, although the status of devoicing in some environments will require an even closer look at the distribution of style and other variables.

3.2 Data collection

3.2.1 Respondents

Most researchers agree that regional differences affect the application of vowel devoicing (see 2.3.1 above). Because this is the first attempt to see the differences according to social groups and age groups, inclusion of region would make this project unmanageable. Since all the respondents in this study are from the Tokyo area, this factor is controlled. All of them grew up in the Tokyo area, and most of them were also born there and have at least one parent who grew up there.

The data from 42 respondents was used for the final statistical analyses. The following table shows the composition of respondents by age, sex, and social class.

Table 3.3: All Social Factors

Age Group	Sex	Social Class			Total
		Working	Lower Middle	Upper Middle	
Younger (15-30)	Male	3	2	3	8
	Female	2	3	2	7
Middle (31-60)	Male	2	3	2	7
	Female	1	3	3	7
Older (61-90)	Male	2	2	2	6
	Female	4	3	0	7
Total		14	16	12	42

3.2.2 Interview procedures

I interviewed each respondent in three stages. First, I asked them some questions to warm them up to the task and make them feel comfortable about being taped. The early questions I asked are demographic: where they were born and raised, where their parents were born and raised, their occupation, their parents' occupation, where they live now, what they like to do for leisure, etc., since such information is important in determining their social status. Then I asked them to read a word list and a reading passage. I prepared a word list of 90 words, phrases or short sentences, containing all the possible combinations of the preceding and following voiceless consonants, including a pause, for both high vowels (see Appendix A). I also prepared a reading passage, which contained as many words/phrases from the word list as possible within a reasonable length (see Appendix B). The whole interview session was recorded on tape. I used a Sony Walkman to record the conversation using regular cassette tapes. Each interview session varied in length, ranging from approximately 20 minutes to 2.5 hours.

3.3 Data handling

3.3.1 Acoustic analyses of the data

The recorded data were transferred and digitized using the sound analysis program Praat. Voicing of the vowels was determined by investigating the 1) waveforms, 2) spectrograms, 3) intensity, and 4) pitch track, as well as by ear to

confirm the instrumental procedures. If the vowel is completely devoiced, its sound wave does not show a periodic wave, nor does it show clear formants in the spectrogram. Its intensity drops, and the pitch track is lost.

Figure 3.1 shows a fully voiced token of the word /see+katsu#hi/ 'living expenses,' and Figure 3.2 shows a clearly devoiced vowel /u/, between /ts/ and /h/, in the same word.

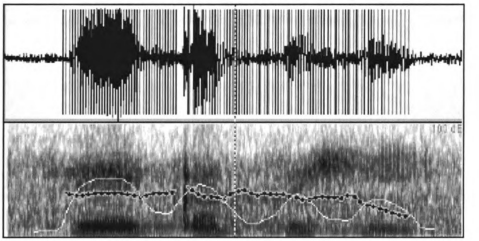

Figure 3.1: /see+katsu#hi/-Voiced

The first big chunk of periodic wave is the first syllable, with a long vowel /see/, and the pitch track (thick black dotted line in the middle of the spectrogram) remains rather stable throughout the syllable. There is also a relatively high intensity line (the thin white line above the pitch track). The second big periodic wave chunk is the second syllable /ka/. Again, there are clear formants, the pitch track stays about the same, and intensity rises in the vocalic portion of the signal. The third periodic wave peak is rather small, but one can still see the clear

formants for the vowel /u/ in the third syllable /tsu/. There is a clear pitch track, which remains stable until it reaches the final syllable. Intensity also rises where the vowel /u/ is produced. Finally, the last peak is the final syllable /hi/. There are clear formants, a pitch track, and an intensity measure. The pitch track shows a decline, which means the previous syllable /tsu/ was accented (cf. Sugito 1982).

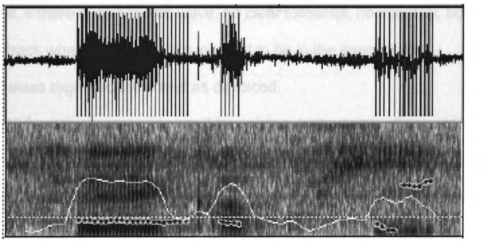

Figure 3.2: /see+katsu#hi/-Devoiced

In Figure 3.2, the first big chunk of periodic wave is the first syllable, /see/, and there are the clear formants in the spectrogram and a well-defined pitch track, which remains very stable throughout the syllable. The intensity level is also high. The small wave peak following is the second syllable /ka/. There are clear formants, the pitch track remains at about the same height, and intensity rises as the vowel is produced. However, there are no formants, pitch track, nor intensity movement where the third syllable /tsu/ should be. There is a small intensity raise where /ts/ is released, but the next pitch track and formants

represent the vowel /i/ in the final syllable /hi/. The pitch track for /hi/ shows a sharp drop within the syllable, which indicates the devoiced /tsu/ was accented and the accent was manifested by the steep drop of the pitch height in the following syllable (cf. Sugito and Hirose 1988).

There are cases, however, in which it is hard to determine voicing. In such cases, if three of the above criteria were met, I coded the vowel as devoiced. For example, if there is no periodic wave, no clear formants, no intensity, but there is a pitch track where the vowel is supposed to be in the spectrogram, I nevertheless regarded the vowel as devoiced.

All five vowels were analyzed for voicing: high vowels after a voiceless consonant and non-high vowels between voiceless consonants. I chose these options because high vowels can be devoiced even before a voiced consonant (Maekawa 1983 and 1988, Sugito 1988), and even non-high vowels can be devoiced between voiceless consonants (Sakuma 1929, Maekawa 1988, Jun and Beckman 1994, Tsuchida 1997), which is the best environment for devoicing in general.

The pitch accent pattern is also confirmed by using the pitch tracker in Praat, discussed more thoroughly below.

After the acoustic analysis was done, all the tokens were coded in an Excel sheet for each respondent according to the coding criteria explained in 3.1.

For each respondent, there are approximately 270 tokens in the Word list style, 180 tokens in the Reading passage style, and between 150 to 350 tokens

in the Conversation style. There are 42 respondents in total, and the total number of tokens used for the statistical analyses is over 30,000.

Table 3.4 shows a sample line of data coding for the word /kohitsuji/ 'lamb.'

Table 3.4: Coding of /kohitsuji/

Vowel	Voi.	Pre.C	Fol.C	P.A.P.	M.B.	C.D.E.	S.S.	Gnd.	Age	Res.	Style
o	+	9	5	10	4	x	M	F	62	R	W
i	-	5	4	5	1	0	M	F	62	R	W
u	+	4	j	3	1	x	M	F	62	R	W

In the first row, from the leftmost column, are vowel identity, voicing, preceding consonant, following consonant, pitch accent pattern, morpheme boundary, consecutive devoicing environment, social status, sex, (actual) age, respondent identity, and speech style. For example, the vowel /i/ is devoiced, so it is coded as '-' in the voicing column. It is preceded by [ç], and coded as 5 for the preceding consonant; it is followed by [ts] and coded as 4 in the following consonant column. The accent pattern of /kohitsuji/ is LHLL; therefore the code is 5 (LHL). Since /hitsuji/ is a single morpheme that means 'sheep,' it is coded as 1 for the morpheme boundary type. /i/ is in a typical devoicing environment, but the previous vowel is not, therefore it is coded as 0 for consecutive devoicing environment. For the social factors, this respondent is Lower Middle Class, coded as M; sex is Female, her age is 62, her ID is 'R,' and the tokens were taken from the Word List ('W').

3.3.2 Statistical analyses of the data

The coded data were processed first in tables to see the general pattern of devoicing according to each variable, then in GoldVarb (a logistic regression program) to find out significant factors and the relative significance of the values within each factor. GoldVarb is capable of dealing with the very small numbers in some cells that may arise in the study of conversational data.

In the first GoldVarb run, high vowels and non-high vowels were analyzed separately to see the difference in the vowel devoicing rate. In the non-high vowel run, there were many 'knockouts,' where no vowels were devoiced, and the overall devoicing rate was 5%, which is very low[8]. Therefore, I eliminated the non-high vowels from the following detailed statistical analyses.

In the statistical run for high vowels, there was only one knockout: the Pitch Accent Pattern #14 (#H#), which occurred only three times. The overall devoicing rate was 45%: /u/ was devoiced at 45%, and /i/ at 46%, suggesting no statistically significant difference in devoicing rate between the two.

The knockouts (many for non-high vowels and one (#H#) for high vowels) are not unexpected. Non-high vowels are not likely to devoice compared to high vowels, and a single mora utterance with a high pitch accent is doubly unlikely to devoice because it is a single mora utterance; therefore, it is more natural to voice the vowel so that it can be heard.

The knockout environment and a few other very low devoicing rate environments were eliminated from the subsequent statistical runs to obtain

[8] 524 non-high vowels were devoiced out of 9,560 occurrences (5%), of which /o/ and /e/ were devoiced at 7%, and /a/ at 4%.

better results. It should be noted that these eliminated environments are all linguistic ones: no social factors were eliminated. Therefore, all the statistical results reported in the next chapter include only the high vowels /i/ and /u/ between voiceless consonants or after a voiceless consonant and before a pause. Low devoicing rate pitch accent patterns were eliminated. For the analyses of linguistic environments, the vowels were analyzed separately because of the allophonic alternation in the preceding consonant.

CHAPTER 4

RESULTS

This chapter will discuss the results of the statistical analyses of the data. First, I will report on the results for linguistic factors in 4.1, focusing particularly on the issues that have been discussed in the literature, namely, preceding and following consonants, vowel identity, accent, morpheme boundary, and consecutive devoicing. Then, I will discuss the results for social factors, namely, speech style, age and sex, and social class, in 4.2.

4.1 Linguistic factors

The following discussion is based on the results of statistical analyses using Goldvarb, a logistic regression program. This program enables one to compare cells with a relatively small number of tokens and choose significant factors and factor groups. Goldvarb gives a weight for each factor, which indicates the likelihood of the application of the rule; in this case, devoicing. For example, if the weight associated with a factor is above 0.5, it promotes devoicing, but if the weight is below 0.5, it demotes devoicing. The higher the

weight, the more the factor promotes the rule's application. In this Goldvarb analysis, only high vowels, /i/ and /u/, in a typical devoicing environment (between voiceless consonants or after a voiceless consonant and before a pause) are included. Devoicing in other environments or of non-high vowels is so infrequent that it would be difficult to build a statistical model around a data set that included such items. For linguistic environments, the statistical analysis was done for the high vowels /i/ and /u/ separately because of the different inventories of the preceding consonants due to Japanese phonotactics.

4.1.1 Preceding and following consonant

As discussed in 2.2.1, most linguists seem to agree that a preceding fricative and a following stop separately promote devoicing. This is confirmed in the present study. Table 4.1 shows the results of the Goldvarb run for the preceding consonants for the vowel /i/.

Table 4.1: Preceding consonant for /i/ – Goldvarb

	Preceding Consonant	Weight	Number (devoiced/total)
1	[ʃ]	0.642	1986/2507
2	[tʃ]	0.522	816/1645
3	[ç]	0.513	609/944
4	[k]	0.434	752/1456
5	[p]	0.142	318/705

The table shows that the fricatives and affricates promote devoicing; their weights are all above 0.5. Stops, however, clearly demote devoicing with weights all below 0.5.

Preceding [p] most strongly demotes devoicing for /i/, but it should also be noted that affricates and fricatives are mixed. The alveopalatal affricate [tʃ] is ranked between the fricatives, [ʃ] and [ç]. In other words, the alveopalatal fricative [ʃ] strongly promotes devoicing, but the palatal fricative [ç] and the alveopalatal affricate [tʃ] somewhat promote it, and there is only a 0.01 difference between the latter two.

As for the stops, even though both stops demote devoicing, the labial stop [p] strongly demotes it with the weight of only 0.142.

I now turn to the results for the vowel /u/. Table 4.2 shows the results of the Goldvarb run for preceding consonants.

Table 4.2: Preceding consonant for /u/ – Goldvarb

	Preceding Consonant	Weight	Number (devoiced/total)
1	[ɸ]	0.706	700/1107
2	[s]	0.642	1998/2660
3	[ts]	0.577	699/1326
4	[k]	0.341	965/2111
5	[ʃ]	0.276	278/705
6	[p]	0.151	289/506

The preceding bilabial fricative [ɸ] is the best promoter for /u/ devoicing. The next best promoter is [s], followed by the affricate [ts]. Stops also demote /u/ devoicing, and, again, [p] most dramatically. However, there is a striking difference from the results for /i/; the alveopalatal fricative [ʃ], which is the best promoter for /i/ devoicing, is a strong demoter for /u/. Since [ʃ] is an allophone of /s/ before /i/, but it is a phoneme before /u/, perhaps this striking difference can be accounted for phonologically. I will return to this question in the more detailed interpretation of results to follow in Chapter 5.

Now I turn to the results for the following consonants. Table 4.3 shows the results of the Goldvarb run for consonants following /i/.

Table 4.3: Following consonant for /i/ – Goldvarb

	Following Consonant	Weight	Number (devoiced/total)
1	[t]	0.847	1829/2017
2	[k]	0.826	1036/1145
3	[s]	0.756	309/388
4	[ts]	0.731	321/379
5	[tʃ]	0.697	315/497
6	[ʃ]	0.432	254/397
7	[p]	0.185	244/585
8	pause	0.119	102/882
9	[h]	0.039	54/575
10	[ç]	0.014	14/184
11	[ɸ]	0.005	3/207

The top two promoting consonants are both stops ([t] and [k]), with a very high weight (above 0.8), but the alveolar fricative [s] comes next. The next two best promoters are both affricates ([ts] and [tʃ]). Even though [ʃ] somewhat demotes devoicing (its weight is slightly below 0.5), there is a large gap between [ʃ] and [p], and everything below [ʃ] strongly demotes devoicing; [p], pause, and the allophones of /h/ ([h], [ç], and [ɸ]). The general tendency is, then, that following stops promotes devoicing most, followed by affricates and fricatives, although [s] promotes devoicing more than the affricates do, and the split between [s] as a promoter and [ʃ] as a demoter is not accounted for.

There are two exceptions to this general tendency, however. First, the behavior of [p] is strange. [p] ranks considerably lower than other stops, below affricates and even below the fricatives ([s] and [ʃ]); it has a very low weight of 0.185. While other following stops strongly promote devoicing, [p] strongly demotes it.

Second, while alveolar and alveopalatal fricatives ([s] and [ʃ], respectively) are ranked higher, the allophones of /h/, namely [h], [ç], and [ɸ], are ranked at the bottom of the list, with very low weights (below 0.04). This seems to support Tsuchida's (1997) claim that devoicing before /h/ is phonologically prohibited. Otherwise, we cannot explain why the following [s] and [ʃ] promote devoicing (strongly or relatively), but the allophones of /h/ strongly demote it.

Table 4.4 shows the results of the Goldvarb run for the following consonants for the vowel /u/.

Table 4.4: Following consonant for /u/ – Goldvarb

	Following Consonant	Weight	Number (devoiced/total)
1	[ts]	0.861	418/534
2	[t]	0.840	785/919
3	[k]	0.818	1481/1830
4	[tʃ]	0.575	353/486
5	[s]	0.436	462/755
6	pause	0.352	974/1957
7	[ʃ]	0.264	253/741
8	[p]	0.143	73/223
9	[h]	0.065	46/340
10	[ç]	0.048	44/284
11	[ɸ]	0.041	40/348

Here, the general tendency is similar to that for /i/: following stops and affricates promote devoicing and fricatives demote it. This tendency is actually even clearer here. All the stops and affricates except [p] are promoters, and all the fricatives are demoters. Following pause is also a demoter, as it is for the vowel /i/. A difference from the ranking for /i/ is that the following alveodental affricate [ts] is the best promoter for /u/.

If we remove [p] from this ranking, we get a clear rank by feature; for the preceding consonant, fricative > affricate > stop, and for the following consonant, stop > affricate > fricative. The ordering for preceding and following is obviously a complete reversal.

It is interesting that [p] behaves more like fricatives than stops in the following environment. [p] historically changed to [ɸ], a bilabial fricative, which changed to [h] eventually, and its distribution in modern Japanese is very limited. It seems that [p] demotes devoicing in general, both in the preceding and the following environments. In the next chapter, I will comment further on this fact.

So far, predictions from previous research are confirmed; a preceding fricative and a following stop promote devoicing, and devoicing is demoted before allophones of /h/. Another hypothesis to be investigated concerns the interaction between the preceding and following consonants; that is, devoicing is expected to be demoted between two fricatives (Tsuchida 1997).

The results of a cross-tabulation of the preceding and following consonants show that [s_s] and [ʃ_s] environments for the vowel /u/ strongly demote devoicing (24% and 31%, respectively), but the [ʃ_s] environment for /i/, on the contrary, promotes it (84%). Similarly, [s_ʃ] and [ʃ_ʃ] environments for /u/ very strongly demote devoicing (19% and 0%, respectively), but the [ʃ_ʃ] environment for /i/ does not (53%). These results are shown in Table 4.5 below. The percentages are given first, and the numbers in parentheses indicate the actual number of devoiced tokens and the total number of occurrences.

Table 4.5: Devoicing between preceding and following fricatives: [s] and [ʃ]

/u/	Preceding: [s]	Preceding: [ʃ]
Following: [s]	24% (23/95)	31% (16/51)
Following: [ʃ]	19% (21/109)	0% (0/52)
/i/		
Following: [s]	N/A	84% (58/69)
Following: [ʃ]	N/A	53% (57/108)

An affricate + [ʃ] combination for both vowels demotes devoicing: [tʃ_ʃ] for /i/ at 11% and [ts_ʃ] for /u/ at 20%. However, an affricate + [s] combination does not: [tʃ_s] for /i/ at 98% and [ts_s] for /u/ at 50%. This is shown in Table 4.6 below.

Table 4.6: Devoicing between a preceding affricate and following fricative

	Preceding: [ts] (/u/)	Preceding: [tʃ] (/i/)
Following: [s]	50% (66/131)	98% (133/136)
Following: [ʃ]	20% (20/100)	11% (5/47)

On the other hand, devoicing between a preceding fricative and a following affricate seems to strongly promote devoicing, as shown in Table 4.7.

Table 4.7: Devoicing between a preceding fricative and following affricate

	Preceding: [s] (/u/)	Preceding: [ʃ] (/u/)	Preceding: [ʃ] (/i/)
Following: [ts]	79% (66/84)	84% (37/44)	98% (136/139)
Following: [tʃ]	99% (78/79)	92% (86/93)	96% (68/71)

Devoicing before a (non-/h/) fricative and after an allophone of /h/ is promoted; [ç_s] and [ç_ʃ] for /i/ at 94% and 80%, respectively, and [ɸ_s] and [ɸ_ʃ] for /u/ at 72% and 49%, respectively.

Table 4.8: Devoicing between preceding /h/ and following non-/h/ fricative

	Preceding: [ɸ] (/u/)	Preceding: [ç] (/i/)
Following: [s]	72% (112/156)	94% (46/49)
Following: [ʃ]	49% (23/47)	80% (73/91)

Devoicing before an allophone of /h/ and after a non-/h/ fricative is strongly demoted, as shown in Table 4.9.

Table 4.9: Devoicing between preceding non-/h/ fricative and following /h/

	Preceding: [s] (/u/)	Preceding: [ʃ] (/u/)	Preceding: [ʃ] (/i/)
Following: [h]	22% (10/45)	11% (8/73)	10% (7/69)
Following: [ç]	5% (2/44)	5% (2/42)	6% (4/62)
Following: [ɸ]	37% (31/83)	3% (3/99)	2% (1/46)

Devoicing between allophones of /h/ is also strongly demoted, as shown in Table 4.10.

Table 4.10: Devoicing between allophones of /h/

	Preceding: [ɸ] (/u/)	Preceding: [ç] (/i/)
Following: [h]	10% (8/84)	15% (17/115)
Following: [ç]	4% (3/70)	13% (5/40)
Following: [ɸ]	2% (1/41)	0% (0/43)

Thus, it is not conclusive that devoicing between two fricatives is demoted. Devoicing after a fricative and before allophones of /h/ is strongly demoted, but this is probably because of the prohibition against devoicing before an allophone of /h/, as argued by Tsuchida (1997). The present results show that, except for some cases, such as the devoicing of /u/ between non-/h/ fricatives and before [ʃ] and after an affricate, devoicing between two fricatives is, in fact, promoted.

In summary, a preceding fricative and a following stop promote devoicing, devoicing is demoted before allophones of /h/, and the prohibition of devoicing between two fricatives claimed in Tsuchida (1997) was not confirmed in the present study.

4.1.2 Vowel identity

The difference in devoicing by the identity of the vowel is still controversial. In the present study /i/ was devoiced at 45.61% and /u/ at 44.9%. From this, /i/

appears to be more frequently devoiced than /u/, but the percentage difference is small. However, the results of a Goldvarb run show that this difference is statistically significant, as shown in Table 4.11.

Table 4.11: Vowel identity – Goldvarb

	Vowel Identity	Weight	Number (devoiced/total)
1	/i/	0.605	4484/7261
2	/u/	0.409	4929/8419

The vowel /i/ promotes devoicing, but /u/ demotes it. It is worth noting that these data include tokens of sentence final /u/ in a copula (e.g., /desu#/), which is almost categorically devoiced for many speakers of Tokyo Japanese, so the greater frequency for /i/-devoicing is perhaps even more surprising.

4.1.3 Accent

Table 4.12 shows the results of a Goldvarb run for pitch accent pattern, discussed in 3.1.1.4 above, for /i/. The potentially devoiced vowel is in the middle position.

Table 4.12: Pitch accent pattern for /i/ - Goldvarb[9]

	Pitch Accent Pattern	Weight	Number (devoiced/total)
1	#L#	0.757	1/3
2	HL#	0.740	48/188
3	LL#	0.705	37/215
4	HLL	0.608	825/907
5	#LH	0.593	568/875
6	LLL	0.573	440/610
7	LLH	0.551	553/795
8	HHH	0.492	831/1223
9	LHL	0.483	145/264
10	#LL	0.465	5/6
11	HHL	0.460	371/629
12	LHH	0.460	454/620
13	HLH	0.356	94/153
14	#HH	0.315	4/7
15	HH#	0.254	15/349
16	#HL	0.218	89/282
17	LH#	0.058	1/131

All the patterns that promote devoicing (above 0.5) are low-pitched. Although the #L# pattern, which is a single mora utterance, is the best promoter statistically, we can safely dismiss it because of the small number of tokens. Excluding #L#, the top two promoters are both pre-pausal low-pitched vowels.

All the accented vowels (9, 11, and 16) demote devoicing (below 0.5), although the LHL pattern (9) is ranked rather high with a weight of 0.483. An

[9] The #H# pattern is excluded in this Goldvarb run because it was a "knockout," which means there was no variation. In this case, there were three occurrences of this pattern, and none of them were devoiced.

initial accented vowel (16) is a strong demoter with a weight of 0.218. However, the strongest demoters are pre-pausal high-pitched vowels.

Among the patterns that demote devoicing (below 0.5), there are two low-pitched vowels, namely, 10 and 13. 10 has a relatively small number of occurrences, but 13 has a large number. When a low-pitched vowel is located between two high-pitched vowels, it seems to resist devoicing.

Table 4.13 shows the results of a Goldvarb run for the pitch accent pattern for the vowel /u/.

Table 4.13: Pitch accent pattern for /u/ - Goldvarb

	Pitch Accent Pattern	Weight	Number (devoiced/total)
1	LLL	0.762	591/738
2	HLL	0.713	422/738
3	HHH	0.656	827/1493
4	LLH	0.608	701/863
5	LL#	0.600	528/878
6	HL#	0.599	437/715
7	#LL	0.590	3/4
8	HLH	0.504	135/224
9	LHH	0.478	229/366
10	HHL	0.408	97/341
11	#HL	0.400	64/96
12	#L#	0.299	1/3
13	#LH	0.273	774/1185
14	LHL	0.130	110/398
15	#HH	0.095	2/7
16	HH#	0.089	7/203
17	LH#	0.004	1/165

Similar to the results for /i/, all the patterns that promote devoicing (above 0.5) are low-pitched except for the HHH pattern (pattern 3), which is a good promoter for /u/. Accented vowels (10, 11 and 14) all demote devoicing (below 0.5), although the HHL and #HL patterns (10 and 11, respectively) are ranked rather high compared to Table 4.12. Although accented vowels are demoters, they are not the strongest ones. The strongest demoters are the pre-pausal vowels that are high pitched (16 and 17), and this is clearer in the case of /u/ than of /i/ (weights of 0.089 and 0.004 for /u/ vs. 0.254 and 0.058 for /i/, respectively).

There are two patterns with a low-pitched vowel that demote devoicing (below 0.5), namely, 12 and 13. 12 is the case of a single syllable utterance with a small number of occurrence, but 13 has a relatively large number of occurrence. Besides, it is the low-pitched vowel in an initial mora followed by a high-pitched vowel, where one would expect a promotion of devoicing based on earlier studies (Martin 1952 [cited in Vance 1987], Yuen 1997). It is true that low-pitched /u/ in an initial mora followed by another low-pitched vowel promotes devoicing, and low-pitched /i/ in an initial mora followed by a high-pitched vowel also promotes it, but any other vowel in an initial mora resists it.

It is also interesting that the pre-pausal low-pitched vowels (5 and 6) are among the promoters but not the strongest for /u/. The tokens include the occurrences of the copula ("desu#"), where the final vowel is almost categorically devoiced for most speakers of the Tokyo dialect. One would have expected that such environments would be the best promoters for devoicing.

Nagano-Madsen (1995) found that devoicing was strongly demoted before [ʃ], [ç], and [ɸ] when accented, and NHK's *Japanese Pronunciation and Accent Dictionary* (1985) also states that devoicing is inhibited before /h/ when the vowel is accented. Table 4.14 shows the devoicing of these environments.

Table 4.14: Accented vowels and the following consonant

Following Consonant	LHL	HHL	#HL
[ʃ]	41% (31/75)	59% (94/158)	13% (6/48)
[ç]	N/A	28% (11/40)	0% (0/1)
[ɸ]	0% (0/1)	3% (3/96)	2% (2/128)
[h]	0% (0/7)	12% (26/223)	0% (0/7)

From the table, it seems that a following /h/ does demote devoicing when the vowel is accented, but it is not clear if the following [ʃ] also demotes it. However, this tendency may be a reflection of the prohibition of devoicing before /h/ in general.

It has been argued that there is a generational difference in vowel devoicing in an accented syllable; namely, younger speakers devoice accented vowels more than older speakers do (Sakurai 1985, Tsuchida 1997). Table 4.15 shows the results of a cross tabulation of pitch accent pattern (only accented vowels) and age.

Table 4.15: Accented vowels and age

Age	LHL	HHL	#HL
Younger	37% (88/236)	50% (173/343)	44% (60/135)
Middle	44% (97/219)	50% (168/336)	34% (41/120)
Older	34% (70/208)	43% (127/294)	42% (52/123)

For the LHL pattern, Middle Age respondents are the best devoicers, then Younger, and Older are the least, although the percentage differences are small. For the HHL pattern, Younger and Middle Age respondents devoice at the same percentage (50%), and Older respondents devoice less (43%). For the #HL pattern, Younger respondents devoice most at 44%, then Older at 42%, and Middle come last at 34%. The percentage differences are very small in any pattern. It seems that Older respondents devoice least in general (or at least in two out of three patterns), but Younger and Middle Age respondents devoice at a similar rate. It may be true that, if we take an average percentage, the order is

Younger (43.7%), Middle (42.7%), Older (39.3%), in terms of more devoicing, but the differences would be very subtle. This is, in fact, similar to the general results for age differences (see 4.2.2 below). I found an interaction between age and sex and concluded that I should not look at the age groups alone, apart from sex. From this table, it is not clear if age has any effect on the devoicing of accented vowels, independent of the effect of age on devoicing in general.

A cross tabulation of age/sex group and pitch accent pattern shows an interesting result, as shown in Table 4.16 below.

Table 4.16: Age/Sex and Pitch Accent Pattern[10]

	YM	MM	MF	OM	OF	YF
LHL	52% (65/126)	47% (55/116)	41% (42/102)	35% (30/85)	33% (40/123)	21% (23/110)
HHL	62% (116/186)	49% (78/160)	51% (90/175)	46% (60/130)	41% (67/163)	36% (57/157)
#HL	52% (34/66)	34% (21/61)	34% (20/59)	33% (18/55)	50% (34/68)	38% (26/69)
LLL	84% (220/263)	77% (195/252)	71% (165/231)	77% (127/165)	79% (172/217)	69% (152/220)
LLH	86% (264/307)	76% (222/294)	75% (209/279)	79% (174/221)	73% (205/280)	65% (180/277)
HLL	83% (261/315)	79% (218/275)	76% (216/283)	74% (163/221)	71% (190/266)	70% (200/286)
HLH	80% (53/66)	62% (30/48)	56% (41/73)	62% (40/64)	61% (41/67)	41% (24/59)
LHH	84% (154/184)	73% (126/172)	70% (112/160)	68% (106/155)	63% (106/167)	53% (79/149)
HHH	71% (359/506)	67% (336/499)	60% (271/454)	61% (224/369)	56% (243/433)	50% (227/457)
#LH	72% (276/383)	69% (229/332)	64% (206/323)	65% (217/332)	63% (227/363)	57% (187/327)
LL#	60% (142/236)	49% (95/192)	50% (86/172)	48% (67/140)	46% (69/149)	52% (106/204)
HL#	66% (120/182)	54% (82/152)	49% (65/133)	51% (72/142)	38% (52/136)	59% (94/158)

The Age/Sex group is ordered so that it reflects the overall devoicing rate from left to right (high to low devoicing rate). The top three pitch accent patterns are the ones with an accented vowel.

It is always the case that Younger Males devoice most in each pitch accent pattern, and it is almost always true that Younger Females devoice least

[10] The patterns with a very low frequency (#LH, #HH, and #L#) and those with a very low devoicing rate (LH# and HH#) are excluded from this table.

of all, except for three pitch accent patterns, namely #HL, LL#, and HL# (the shaded cells). Among the accented vowel patterns, it is true that Younger Males devoice more than Older respondents, but that is also true with non-accented vowel patterns. It is only the #HL pattern that shows a different pattern from the general picture. In this pattern, Younger Females (38%) devoice more than Middle Age Males (34%), Middle Age Females (34%), and Older Males (33%), although the difference is small. Another unusual fact about this pattern is that Older Females (50%) devoice almost as much as Younger Males (52%) do (the #HL shaded cell). The accented vowel in the word-initial mora somehow promotes devoicing among younger speakers and older females.

The other two patterns where Younger Females devoice more than Middle Age and Older respondents are both pre-pausal low-pitched vowels. In both cases Younger Males still devoice the most, but Younger Females are the second most frequent devoicers. In this environment, we can say that younger speakers devoice more than older generations.

In summary, the most demoting pitch accent patterns are those with a high-pitched vowel before a pause; there seems to be a tendency for low-pitched vowels to be more likely to be devoiced than high-pitched vowels, and accent

seems to have some influence on devoicing, with accented vowels tending to resist devoicing, contrary to claims in the recent literature (Sugito 1982, Sakurai 1985, Maekawa 1988, Sugito and Hirose 1988, Kondo 1993, Nagano-Madsen 1995, Imai 1997, Tsuchida 1997).

The proposed interaction between accent and the following consonant (i.e. devoicing is demoted before [ʃ] or /h/) was not supported in the present study.

As for the interaction between accent and age, it is true that Younger Males devoice more accented vowels than Older and Middle Age speakers, but this does not extend to Younger Females in general. Only the accented vowel in the initial mora promotes devoicing among Younger speakers, both males and females, and extends even to Older Females. In terms of age differences, Younger respondents devoice more in the environment of pre-pausal, low-pitched vowels.

4.1.4 Morpheme boundary

Table 4.17 shows the results of a Goldvarb run for morpheme boundaries, discussed in 3.1.1.3 above, for the vowel /i/.

Table 4.17: Morpheme boundary types for /i/ - Goldvarb

	Morpheme Boundary	Weight	Number (devoiced/total)
1	3 (Bound morpheme)	0.620	2114/2900
2	1 (No boundary)	0.600	1901/2493
3	2 (Pause)	0.273	102/878
4	5 (Word boundary)	0.175	256/540
5	4 (Compound)	0.163	108/446

It has been argued that a morpheme boundary demotes devoicing (Vance 1987, 1992, Kondo 1997, Tsuchida 1997). From the table, we can see that devoicing is promoted when the vowel is morpheme internal (type 1), and when it is at a bound morpheme boundary (type 3). When the vowel is before a pause (type 2), devoicing is demoted, and a word boundary and compound word boundary strongly demote devoicing. While it is true that devoicing is demoted at a word boundary, a bound morpheme boundary does not demote devoicing but promotes it.

Table 4.18 shows the results of a Goldvarb run for morpheme boundaries for the vowel /u/.

Table 4.18: Morpheme boundary types for /u/ - Goldvarb

	Morpheme Boundary	Weight	Number (devoiced/total)
1	1 (No boundary)	0.645	2132/2870
2	3 (Bound morpheme)	0.571	870/1798
3	2 (Pause)	0.467	976/1955
4	5 (Word boundary)	0.302	687/1004
5	4 (Compound)	0.195	264/790

The general tendency is the same here. When the vowel is morpheme internal or followed by a bound morpheme, devoicing is promoted. When the vowel is followed by a pause, it is demoted. When the vowel is at a word boundary, particularly at a compound boundary, it is strongly demoted. Pause has a higher weight for /u/, which may be because of the copula "desu#", which is almost categorically devoiced for many speakers of the Tokyo dialect.

As for Sakurai's (1985) claim that devoicing is demoted at a morpheme boundary and before a fricative, Table 4.19 shows the results of a cross tabulation of morpheme boundary and the following consonant for both /i/ and /u/[11]. The shaded cells are the environments that fit Sakurai's description.

[11] These vowels were combined because of similar results in individual analyses.

Table 4.19: Morpheme boundary and the following consonant

	1 (No bound.)	3 (Bound morph.)	4 (Compound)	5 (Word bound.)
[ʃ]	54% (103/191)	48% (298/620)	31% (66/287)	44% (18/41)
[s]	57% (291/511)	89% (368/415)	46% (86/185)	81% (26/32)
[h]	2% (1/41)	11% (64/563)	8% (11/138)	13% (23/174)
[ç]	0% (0/5)	16% (49/307)	5% (5/111)	9% (4/45)
[ɸ]	21% (33/159)	2% (5/226)	4% (3/85)	2% (2/85)
[tʃ]	75% (464/621)	94% (153/162)	26% (51/199)	N/A (0/0)
[ts]	82% (542/665)	93% (112/120)	47% (22/47)	76% (64/84)
[t]	93% (906/971)	95% (1437/1513)	78% (7/9)	60% (266/445)
[k]	83% (1442/1727)	90% (436/485)	59% (98/166)	91% (539/595)
[p]	53% (252/474)	22% (65/293)	N/A (0/0)	0% (0/38)
Total	75% (4034/5366)	63% (2987/4704)	30% (372/1238)	61% (943/1549)

It seems that the vowels are less likely to devoice at a word level boundary and before some fricatives, but the results are not consistent, and Sakurai's claim cannot be supported.

It has been also argued that morpheme boundaries have a blocking effect on vowel devoicing in consecutive devoicing environments (Sakurai 1985, Vance 1987 and 1992, Kondo 1997, Tsuchida 1997). Table 4.20 shows the results of a

cross tabulation of morpheme boundary and the consecutive devoicing environment for both /i/ and /u/. The shaded cells are the target environments: before a word level boundary and in a consecutive devoicing environment.

Table 4.20: Morpheme boundary and consecutive devoicing environment

	1 (No bound.)	3 (Bound morph.)	4 (Compound)	5 (Word boundary)
0 (Not in a cons. devoicing env.)	78% (3422/4363)	66% (2531/3851)	35% (339/977)	71% (840/1186)
1 (Previous V is not devoiced)	68% (510/746)	57% (249/439)	8% (5/65)	29% (59/207)
2 (Previous V is devoiced)	40% (102/256)	50% (206/411)	14% (28/194)	29% (44/151)

The table shows that even when it is not in a consecutive devoicing environment, a compound word boundary demotes devoicing. As for the vowels at a word level boundary in a consecutive devoicing environment, it seems that devoicing is demoted more than the rest of the morpheme boundary types (i.e. no boundary and bound morpheme boundary), but that confirms two independent tendencies, not the interactive deterrent to devoicing suggested in earlier work. Consecutive devoicing is discussed in greater detail below.

In summary, devoicing is promoted when the vowel is morpheme-internal or when it is at a bound morpheme boundary. It is demoted at any other boundary type; pause, word boundary, and compound boundary, confirming previous studies.

4.1.5 Consecutive devoicing

Table 4.21 shows the results of a Goldvarb run for the consecutive devoicing environment for the vowel /i/.

Table 4.21: Consecutive devoicing environment for /i/ - Goldvarb

	Consecutive Devoicing	Weight	Number (devoiced/total)
1	0 (Not in a consecutive devoicing environment)	0.538	3862/5650
2	1 (Previous vowel is not devoiced)	0.423	453/993
3	2 (Previous vowel is devoiced)	0.286	166/614

The only promoting factor here is the environment in which the previous vowel is not in a devoicing environment (1 in Table 4.21). Devoicing is demoted when the vowel is in a consecutive devoicing environment (2 and 3), and, unexpectedly, even when the previous vowel is not devoiced (2). However, when

the vowel is in a consecutive devoicing environment, the vowel is more likely to be devoiced when the previous vowel is not devoiced than when the previous vowel is devoiced; 2 has a much higher weight than 3. In other words, there is a strong tendency for the avoidance of consecutive devoicing.

It is interesting, however, that when the previous vowel is also in a devoicing environment, the devoicing of the vowel is demoted even when the previous vowel is actually not devoiced. It seems that as soon as the speakers realize that there are potentially devoiced vowels in a sequence, they try to avoid devoicing, and end up voicing both more than half the time. I will comment further on this in the discussion chapter below.

Table 4.22 shows the results of a Goldvarb run for the consecutive devoicing environment for the vowel /u/.

Table 4.22: Consecutive devoicing environment for /u/ - Goldvarb

	Consecutive Devoicing	Weight	Number (devoiced/total)
1	0 (Not in a consecutive devoicing environment)	0.642	4299/6684
2	2 (Previous vowel is devoiced)	0.108	238/886
3	1 (Previous vowel is not devoiced)	0.082	392/847

Here, as with /i/, the only promoting factor is the one in which the previous vowel is not in a consecutive devoicing environment. However, the difference is that when the vowel is in a consecutive devoicing environment, devoicing is much more strongly demoted. Also, the order is reversed; it is demoted even more strongly when the previous vowel is not devoiced than when the previous vowel is devoiced. Since the weight difference is very small, I will not focus on the reversed order, but it is still true that in both cases of consecutive devoicing environments, devoicing is very strongly demoted. In other words, it does not matter if the previous vowel is devoiced or not. The speakers appear to be aware, subconsciously of course, of the danger of consecutive devoicing and try to avoid it, resulting in not devoicing any vowels at all.

It is natural to hypothesize that consecutive devoicing would be more common in more casual speech. Table 4.23 shows the results of a cross tabulation of consecutive devoicing environment and style.

Table 4.23: Consecutive devoicing environment and Style

	0 (Not in a consecutive devoicing environment)	1 (Previous vowel is not devoiced)	2 (Previous vowel is devoiced)
C	86% (2986/3469)	87% (62/71)	51% (75/147)
RP	71% (2424/3410)	49% (231/475)	36% (105/292)
WL	50% (2756/5465)	43% (552/1295)	21% (224/1061)

The shaded cells are the cases of consecutive devoicing. It is confirmed that consecutive devoicing is more common in the Conversational style, at 51%, less likely in the Reading Passage style, at 36%, and most unlikely in the Word List style, at 21%. However, even in the most formal style, the Word List style, consecutive devoicing does occur rather more frequently than previous research or prescriptive rules would suggest.

4.2 Social Factors

This section will discuss the results of the statistical analyses using Goldvarb for the social factors, namely style, age, sex, and social class. The statistical analyses were done for both vowels separately since it was found that there are cases in which social factors have a very different effect on /i/ and /u/.

4.2.1 Speech style

As noted in 3.1.2.4 above, speech style is the most significant factor in vowel devoicing in Japanese (Yuen 1997). Table 4.24 shows the results of a Goldvarb run for speech style for the vowel /i/.

Table 4.24: Speech style for /i/ - Goldvarb

	Speech Style	Weight	Number (devoiced/total)
1	Conversation	0.816	1585/1785
2	Reading passage	0.486	1097/1732
3	Word list	0.335	1799/3740

The results confirm Yuen's findings; the more formal the speech style is, the less frequently devoicing occurs. In fact, only conversational style promotes devoicing, and the word list and reading passage styles demote it, even though devoicing is more likely to occur in reading passages than in word lists.

Table 4.25 shows the results of a Goldvarb run for speech style for the vowel /u/.

Table 4.25: Speech style for /u/ - Goldvarb

	Speech Style	Weight	Number (devoiced/total)
1	Conversation	0.742	1585/1785
2	Reading passage	0.590	1097/1732
3	Word list	0.330	1799/3740

Here, both the conversational and reading passage styles are promoters for devoicing, and only the word list style demotes it. However, the general order is the same; the more casual the style, the more likely devoicing occurs.

4.2.2 Age and sex

The individual results for age and sex revealed an interaction between them. Therefore, these factors are combined. Table 4.26 shows the results for age and sex combined for the vowel /i/.

Table 4.26: Age and sex combined for /i/ - Goldvarb

	Age & Sex	Weight	Number (devoiced/total)
1	Younger Male	0.614	911/1303
2	Middle Male	0.517	795/1248
3	Middle Female	0.486	766/1243
4	Older Male	0.477	620/1030
5	Older Female	0.473	461/1258
6	Younger Female	0.418	628/1175

Yuen (1997) argued that men devoice more than women, but this is not true across age groups. Since Middle Females devoice more than Older Males, for example, we cannot say that men always devoice more than women. Figure 4.1 shows this visually.

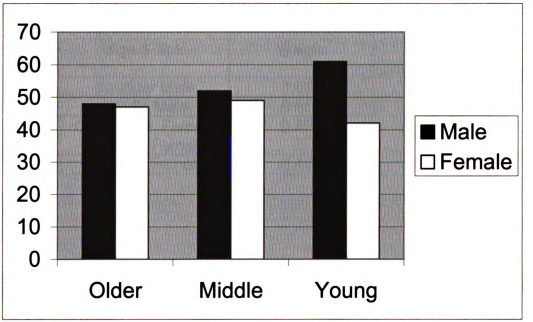

Figure 4.1: Age and Sex for /i/

The sex difference is very subtle for Older and Middle respondents. It is obviously the Younger Males who contribute to the high devoicing rate for males and the Younger Females who contribute to the low devoicing rate for females. In fact, the differences between Older Males, Older Females, and Middle Females

are so small that they were combined to form one group, and the results were not significantly different. Table 4.27 and Figure 2 show the results of the combination.

Table 4.27: Age and sex for /i/ - Older Male, Female, and Middle Female combined

	Age & Sex	Weight	Number (devoiced/total)
1	Younger Male	0.614	911/1303
2	Middle Male	0.517	795/1248
3	Older Male, Female & Middle Female	0.479	2147/3531
4	Younger Female	0.418	628/1175

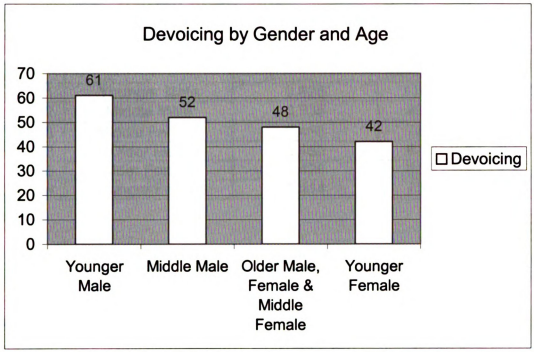

Figure 4.2: Age and Sex for /i/ - Older Male, Female, and Middle Female combined

It is clear that Younger Males are the greatest promoters of devoicing, and Younger Females are the biggest demoters. Middle males only somewhat promote devoicing and the rest (Older Males, Older Females, and Middle Females) are all demoters.

Table 4.28 shows the results for age and sex combined for the vowel /u/.

Table 4.28: Age and sex combined for /u/ - Goldvarb

	Age & Sex	Weight	Number (devoiced/total)
1	Younger Male	0.626	1167/1673
2	Middle Male	0.535	899/1442
3	Middle Female	0.485	762/1344
3	Older Male	0.480	679/1196
5	Older Female	0.426	691/1342
6	Younger Female	0.414	731/1420

Here, the order is exactly the same, and the weights are very similar to those of /i/. Figure 4.3 below shows this visually.

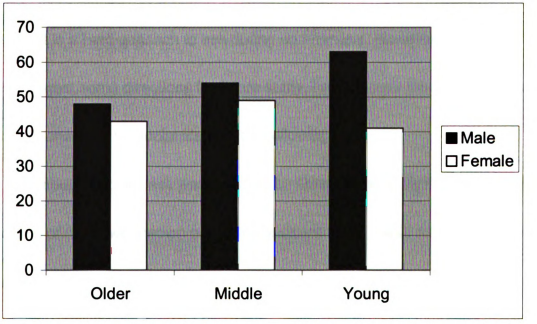

Figure 4.3: Age and Sex for /u/

The differences between males and females are larger for /u/ for all age groups, but the sex difference for Young respondents is still much larger than that for Older and Middle Age respondents. Because the sex differences in each age group are larger than those for /i/, I could not combine any groups.

4.2.3 Social class

There are always problems in social class classification; in this case, the basis for neighborhood classification is weak, and income is not included because it is a hard question to ask during an interview. However, assuming it might suggest some directions for future study, I will discuss the results of the statistical analyses for social class in the following.

Although social class was selected by Goldvarb as a significant factor for devoicing of /u/, it was thrown out as insignificant for /i/. Table 4.29 shows the results for social class differences for /u/.

Table 4.29: Social class for /u/ – Goldvarb

	Social class	Weight	Number (devoiced/total)
1	Middle	0.520	1859/3149
2	Working	0.490	1550/2731
3	Upper	0.486	1520/2537

Although significant, the differences among social classes are very small. The Middle Class somewhat promotes devoicing, while the Working and Upper Middle classes only slightly demote it, and the difference between them was not significant. Table 4.30 shows the results of this combination.

Table 4.30: Social class – Working and Upper combined – for /u/

	Social class	Weight	Number (devoiced/total)
1	Middle	0.519	1859/3149
2	Working& Upper	0.488	3070/5268

Since Younger Males devoice most, it is reasonable to hypothesize that this feature is nonstandard because younger males are prone to the covert prestige often associated with nonstandard features. One would, therefore, expect to find the typical pattern of nonstandard features associated with social class, in which the lower the social class, the more nonstandard features one should find. However, that is not the case here. The pattern is that Middle class people devoice most, and Working and Upper classes devoice least. This pattern is more typical for a standard feature, particularly if the greater use by the Middle Class is representative of the linguistic insecurity often exhibited by Lower Middle

Class respondents in much sociolinguistic work. I will provide a more detailed discussion on this distribution in the interpretation section below.

4.3 Summary

The results for the more sophisticated statistical treatment of this large sample show both correspondences and a lack of correspondence with previous work. I'll summarize each correspondence and non-correspondence below. Note that within a single factor, we have several different results and some of them may show correspondence, and others may show non-correspondences. Those factors that confirmed previous studies are as follows.

(1) Effect of the preceding and following consonant: a preceding fricative and a following stop promote devoicing most, and devoicing is demoted before /h/.

(2) Effect of accent: accented vowels resist devoicing, and pre-pausal high-pitched vowels very strongly demote devoicing. This confirms the traditional description of Japanese vowel devoicing as opposed to more recent studies (Sugito and Hirose 1988, Kondo 1993, Nagano-Madsen 1995, Tsuchida 1997).

(3) Effect of morpheme boundary: word boundary, including compound boundary, demotes devoicing, whereas no boundary and bound morpheme boundary promotes it.

(4) Avoidance of consecutive devoicing: devoicing is demoted in a consecutive devoicing environment.

(5) Effect of speech style: the more casual the speech style is, the more frequently devoicing occurs.

Those factors that did not support the previous studies are as follows.

(1) Interaction between the preceding and following consonants: the claim that devoicing is prohibited between two fricatives (Tsuchida 1997) is not supported by the present study.

(2) Effect of vowel identity: the vowel /i/ promotes devoicing, but /u/ demotes it. This contradicts the claim made by Han (1962), but supports Yuen's (1997) results.

(3) Effect of age in the devoicing of accented vowels: the present study did not completely support the claim that younger speakers devoice accented vowels more than older speakers do. It is only young males who devoice more than older speakers, and younger females tend to devoice less than older speakers.

(4) Interaction between accent and the following consonant: the claim that devoicing is demoted before [ʃ] or /h/ when accented (NHK 1985, Nagano-Madsen 1995) is not supported by the present study.

(5) Interaction between morpheme boundary and the following consonant: the claim that devoicing is demoted before a fricative at a morpheme boundary (Sakurai 1985) is not supported by the present study.

(6) Effect of morpheme boundary in a consecutive devoicing environment: the claim that devoicing is demoted at a morpheme boundary in a consecutive devoicing environment is not supported in this study; the two demoting factors are independent.

(7) Effect of sex: the claim that men devoice more than women do (Yuen 1997) was not entirely supported in the present study because sex and age show an interaction; younger males devoice most, and younger females devoice least, but these differences are weak or nonexistent in middle-age and older respondents.

Both correspondences and a lack of correspondences, as well as new findings from the present study, will be discussed further in the next, interpretive, chapter.

Chapter 5

Discussion

This chapter will interpret the detailed results reported in the previous chapter. I will discuss linguistic factors in 5.1, and social factors in 5.2, and summarize the major findings in 5.3.

5.1 Linguistic Factors

The present study has generally confirmed the results of previous studies in terms of the promoters and demoters of devoicing by the preceding and following environments. It was also found that accented vowels resist devoicing, contrary to the claims made in recent studies (Sugito 1982, Sakurai 1985, Maekawa 1988, Sugito and Hirose 1988, Kondo 1993, Nagano-Madsen 1995, Imai 1997, Tsuchida 1997). In terms of pitch accent patterns, a pre-pausal low-pitched vowel was the best promoter for /i/, but not for /u/, and a pre-pausal high-pitched vowel was the strongest demoter for both vowels. The effect of morpheme boundary demotion was generally confirmed, but the results for consecutive devoicing environments showed an unexpected pattern. I will discuss these issues in more detail in the following subsections.

5.1.1 Preceding and following consonants

The general picture of promoting and demoting factors in terms of preceding and following consonants obtained from the present study is

consistent with the one repeatedly reported in the literature; preceding fricatives promote devoicing most, then affricates, and stops demote it; following stops promote devoicing most, then affricates, and fricatives demote it. However, the behavior of [ʃ] and [p] do not conform to the general picture, and a following pause demotes devoicing, contrary to the standard description of vowel devoicing in Japanese (e.g. McCawley 1968, Vance 1987).

The present study also supports Tsuchida's (1997) claim that devoicing before an allophone of /h/ is phonologically prohibited; I found that it is strongly demoted. However, it did not clearly support another claim of hers that devoicing between two fricatives is also phonologically prohibited, because devoicing before [s] or [ʃ] and after [s], [ʃ], or an allophone of /h/ is rather promoted, except for some cases for the vowel /u/ (refer to Tables 4.5 and 4.8).

5.1.1.1 Status of [ʃ] and [p]

As seen in the previous chapter, the behavior of [ʃ] and [p] is unusual. First, a preceding [ʃ] is the best promoter for the devoicing of /i/ but is a strong demoter for /u/ (refer to Tables 4.1 and 4.2). When [s] and [ʃ] occur in the following environment, [ʃ] tends to fall behind [s]; [s] is a good promoter for /i/ with a weight of 0.756, but [ʃ] is a demoter, with a weight of 0.432, and both [s] and [ʃ] demote the devoicing of /u/, but [s] demotes less, as shown by its higher weight, (0.436), compared to [ʃ] (0.264) (refer to Tables 4.3 and 4.4).

According to Shibatani (1990), the "palatalized consonants ([ʃ] and [tʃ]) have a skewed pattern of distribution" (163). He argues that the combinations [si] and [ʃe] do not occur[12]; therefore, they are in complementary distribution in the environment of front vowels, and the distribution of [ʃ] is limited before non-front vowels (163). He goes on to argue that [ʃ] and [tʃ] before /i/ are allophones of /s/ and /t/, respectively, but before other vowels, as in [ʃa] and [tʃa], they are derived from /sja/ and /tja/ (164). I understand that this suggests that they are equivalent to palatalized phonemes /s^y/ and /t^y/, respectively, but Shibatani does not give an explanation for this skewed distribution of the palatalized phonemes. Thus, [ʃ] is an allophone of /s/ before /i/, but it is a phoneme before /u/. Since preceding /s/ is a promoter for devoicing but /ʃ/ is not, the different behavior of those two fricatives can be accounted for to some degree by this distinction. Even this apparent underlying difference, however, does not account for the difference between the two if we accept the generalization that preceding fricatives are expected to promote devoicing. The results here suggest a variable phonological interpretation.

A preceding [p] is a very strong demoter for the devoicing of both high vowels (refer to the Tables 4.1 and 4.2). This is expected because [p] is a stop, and stops are expected to demote devoicing when they occur in the preceding environment. However, in the following environment, where stops are expected

[12] [ʃe] only occurs in foreign words like 'Shakespeare' (/ʃeekusupia/) and in interjections. Vance (1987) gives an example of [ʃerii] 'sherry' (21). He also states that [ʃe] is easy to pronounce for native speakers of Japanese, but [si] is very difficult, and is usually pronounced as [ʃi].

to promote devoicing, [p], and only [p] among stops, actually functions as a demoter. For both /i/ and /u/, [p] is a very strong demoter with a weight below 0.2 (cf. Tables 4.3 and 4.4).

According to Shibatani (1990), "[p] does not occur in initial position in native or Sino-Japanese words" (163), and "the distribution of [p] is extremely limited in the native and Sino-Japanese vocabularies. ... [it] is limited to the environment of consonant clusters, e.g. *yappari* 'as expected', *simpai* 'worry'" (166). Historically, [h] was derived from [ɸ] which was itself derived from [p], which explains the alternation between [h] and [p] (*hoo* "law" vs. *ken-poo* "constitution"), and [h] and [b] (*hito* "person" vs. *hito-bito* "people") (Shibatani 1990; 166-7). [ɸ] remains only before /u/ in modern Japanese, and the distribution of [p] is also limited in the native and Sino-Japanese vocabularies, although it is a phoneme.

Considering the status of both /ʃ/ and /p/, which have very limited distributions in modern Japanese, I am tempted to suggest that vowel devoicing is sensitive to the status of the phoneme. It seems that /ʃ/ and /p/ do not have full status as phonemes, and this is reflected in the process of vowel devoicing. However, more study is needed to determine the status of these two phonemes and the relationship of this status to vowel devoicing. As with the sibilant distinctions discussed above, the data here point to a variable phonological rather than phonetic influence.

5.1.1.2 Devoicing before a pause

The standard description of vowel devoicing in Japanese is that the high vowels (/i/ and /u/) are devoiced between voiceless consonants or between a voiceless consonant and a pause (Sakuma 1929, McCawley 1968, Kawakami 1977, Vance 1987, Maekawa 1988, Sugito 1988, Kondo 1994, Nagano-Madsen 1995). However, the present study found that a following pause demotes devoicing of both vowels, and it demotes /i/ devoicing more strongly (0.119), than /u/ (0.352) (cf. Tables 4.3 and 4.4). This contradicts the standard description of vowel devoicing in Japanese.

If one also takes pitch accent patterns into consideration, however, a pre-pausal low-pitched vowel was the best promoter for /i/, and the same environment also promotes the devoicing of /u/, although it is not the best promoter. On the other hand, pre-pausal high-pitched vowels demote devoicing very strongly (cf. Tables 4.12 and 4.13).

It is not only in this study that the status of the following pause has been controversial. Other recent studies show that devoicing of word-final vowels is not common, or less likely (Maekawa 1988, Takeda and Kuwabara 1987, Nagano-Madsen 1994, Kondo 1997 [all cited in Tsuchida 1997]). Maekawa (1988) states that an utterance-final pause has the same effect as a following voiceless consonant, i.e. it promotes devoicing, but that a sentence-internal pause demotes devoicing. His study was conducted in the Tottori prefecture (in the western part of Japan) and showed that devoicing of vowels before a

sentence-internal pause is less likely, perhaps due to the fact that most of those vowels have a raised pitch accent.

Kawakami (1977) reports that a high vowel before a pause is devoiced only when the vowel is low-pitched, and this is supported by the present study; the strongest demoter among pitch accent patterns is a pre-pausal high-pitched vowel (cf. Tables 4.12 and 4.13). However, Takeda and Kuwabara (1987) show that word-initial and word-medial [ʃi] was devoiced at 31% and 24%, respectively, but word-final [ʃi] was devoiced at only 1% (Tsuchida 1997), and I assume these are all low-pitched vowels. Kondo (1997) even suggests that devoicing before a pause may be limited to utterance final /desu/ (polite copula) and /masu/ (polite verb suffix) (Tsuchida 1997; 299). However, the present study shows different results. The devoicing of both the low-pitched high vowels /i/ and /u/ is promoted before a pause.

The present study does not distinguish sentence-final vowels from sentence-internal ones, partly because it is difficult to tell if the utterance is a sentence or a part of one in spontaneous conversations. However, the fact that the pre-pausal low-pitched vowel is the best promoting environment for /i/, but the same environment is not the best promoter for /u/ seems to make this irrelevant. If a high rate of devoicing of a low-pitched vowel before a pause is due to the sentence final copula and verb suffix, /u/ should have as its best promoter the pre-pausal low-pitched vowel.

None of the studies mentioned above discuss the influence of vowel identity in general. Therefore, I cannot compare my results with theirs. Besides,

Kondo (1997) used isolated words, while the present study used three different speech styles, which might have caused the difference (see 5.2 below).

5.1.1.3 Status of Affricates

The internal organization of an affricate is still controversial. A traditional view is that it is a combination of two features; a stop and a fricative, in that order. However, more recent studies suggest that an affricate is actually a stop (Steriade 1993, Rubach 1994), or that the features are not ordered (Lombardi 1990).

A previous articulatory study shows that affricates pattern with stops, rather than fricatives, in terms of the glottal gesture in word-initial and word-medial positions (Sawashima and Niimi 1974, cited in Tsuchida 1997). [s] shows a large glottal opening in both positions, but both stops and [ts] show larger glottal openings in word-initial position. This seems to be in line with the claim that affricates are a kind of stop (Steriade 1993, Rubach 1994). In Yoshida and Sagisaka (1990, cited in Tsuchida's 1997 study), this is also supported because the following affricates had a devoicing rate similar to that of the following stops (both stops and affricates have over a 70% devoicing rate), but not to that of fricatives (between 50% and 60%). Tsuchida also stipulates that affricates do not pattern with fricatives based on the fact that a high vowel following an affricate and followed by a fricative is expected to devoice according to NHK (1985), as in (8) below, whereas the devoicing of a high vowel between two fricatives is prohibited.

(8) [tʃi̥ʃio] 'blood'

[tʃi̥sudʒi] 'lineage'

[atsu̥sa] 'thickness'

(Data taken from Tshichida 1997; 303)

In the present study, the tendency of affricates to pattern with stops in the following environment, reported in Yoshida and Sagisaka (1990), is supported (cf. Tables 4.3 and 4.4). However, affricates do pattern with fricatives in the preceding environment (cf. Tables 4.1 and 4.2). Both fricatives and affricates are promoters for both vowels in this environment. If an affricate is actually a combination of a stop and a fricative, then it is the stop that is adjacent to the vowel in the following environment, and the fricative in the preceding environment. Therefore, for the preceding and following environment patterns, the present study supports the traditional view, in which affricates are a combination of a stop and a fricative.

The present study also shows that devoicing after an affricate and before a fricative is strongly demoted when the following fricative is [ʃ], which is consistent with the traditional view of an affricate if we assume Tsuchida's claim that devoicing between two fricatives are prohibited. However, devoicing was not demoted when the following fricative is [s] (cf. Table 4.6). Moreover, devoicing after [tʃ] and before [s] for /i/ is strongly promoted (98% devoicing rate).

It is difficult to account for this difference, although it could be related to the status of [ʃ] as a phoneme, as discussed above. In addition, however, the present study did not support Tsuchida's claim that devoicing is prohibited between two fricatives; therefore, this argument may not be valid in general. In that case, the present study seems to support the traditional view of affricates.

5.1.2 Vowel identity

In the present study, it was found that vowel identity is one of the significant factors for vowel devoicing; the vowel /i/ is more likely to devoice than the vowel /u/. Previous studies disagree on this issue; Han (1962) argues that /u/ is more readily devoiced than /i/; Yuen (1997) reports that /i/ is more likely to devoice than /u/, and Maekawa (1983) and Imai (1997) did not find any difference between the two. However, the present study analyzed a much larger number of tokens than any of these studies; therefore, the slight difference in the devoicing percentages between the two vowels turned out to be significant. These computations include tokens of sentence final polite copula and polite verb suffix (/desu/ and /masu/, respectively), which are almost categorically devoiced for many speakers of Tokyo Japanese (Maekawa 1988). This implies that the devoicing of /i/ is even more likely than that of /u/ if we disregard these instances.

I can only speculate on why /i/ is more likely to devoice than /u/. In Japanese, consonants before /i/ are highly palatalized. This is obviously realized in the allophonic alternation for /t/ and /s/. For example, /s/ becomes [ʃ] before /i/ but remains [s] before all other vowels. Because of this palatalization, speakers

are capable of hearing the difference between devoiced [ʃi] and [ʃu] (Beckman and Shoji 1984). If the vowel is recoverable from the co-articulation of the vowel and the preceding consonant, devoicing may be promoted even more since possible ambiguity is avoided.

This is just a speculation, and we obviously need more study in the difference between /i/ and /u/ in terms of devoicing rate.

5.1.3 Accent

As discussed in 5.1.1.2 above, the strongest demoter of all the pitch accent patterns is that of pre-pausal high-pitched vowels, which is consistent with previous studies (Martin 1952, NHK 1985).

It was also found that low-pitched vowels are more likely to devoice than high-pitched vowels in general, and accent seems to have some influence on devoicing because accented vowels demote devoicing, contrary to claims made in recent studies (Sugito 1982, Sakurai 1985, Maekawa 1988, Sugito and Hirose 1988, Kondo 1993, Nagano-Madsen 1995, Imai 1997, Tsuchida 1997). Although it is true that accented vowels are frequently devoiced (cf. Tables 4.12 and 4.13), the more sophisticated statistical model used in this study shows that accent demotes devoicing in all pitch accent patterns.

It is interesting that the major factor turned out to be the pitch associated with the vowel, not the word accent, because most previous studies focus on the accented vowel and its influence on vowel devoicing. Han (1962) and Maekawa (1983) are the only studies, as far as I know, that looked at L and H pitches. Han

claims that a high vowel between voiceless consonants is generally not devoiced when it has a high pitch but is devoiced when it has a low pitch. However, it is not clear if she meant "accented vowels" by "high pitch." On the other hand, Maekawa concluded that pitch accent does not have an influence on the rate of vowel devoicing. He found that low-pitched high vowels were devoiced 83% of the time, whereas high-pitched vowels were devoiced at a 57% rate (from Table 7, 75), but he attributed this difference to the frequent occurrences of the low-pitched [sɯ] and [ʃi] in /desu/ (polite copula), /masu/ (polite verb suffix), /deʃita/ (past tense of /desu/), and /maʃita/ (past tense of /masu/). When he excluded those cases, the difference between high-pitched and low-pitched vowels was very small (50% and 57%, respectively).

However, Maekawa had a very small number of tokens (453), and he only reports percentages, while the present study has a large number of tokens (over 15,000) and uses a sophisticated statistical program engineered to handle cells with a relatively small number.

In trying to account for the peculiarity of /desu/ and /masu/, Maekawa (1983) points to (1) the intonation associated with the sentence ending and (2) the post-accent position of those devoiced vowels, as in [deˈʃi̥ta], [maˈʃi̥ta], [deˈsɯ̥], and [maˈsɯ̥] (where 'ˈ' indicates an accent shift from high to low). Fujimura (1967) also states that vowel devoicing is more likely after the accented syllable (cited in Maekawa 1983), but it is not clear if he meant the vowel right after the accented vowel, or just any low-pitched vowel after the accented vowel (Maekawa 1983, Note 13).

With the vowels immediately after the accented one (cf. Tables 4.12 and 4.13), those patterns with the HLX sequence (X indicates high or low pitch segment; 2, 4, and 13 in Table 4.12 and 2, 6, and 8 in Table 4.13) are mostly promoters for both vowels. The only exception is the HLH pattern for the vowel /i/, which demotes devoicing. A low-pitched vowel placed between two high-pitched vowels resists devoicing. This may be because of the effort to preserve the pitch shift which otherwise may be cancelled if devoicing occurred. It is also possible that, since this pitch accent pattern is only possible at a word boundary, it demotes devoicing because of the word boundary (cf. 4.1.4).

Another finding of the present study is that accented vowels resist devoicing, contrary to recent studies (such as Sugito 1982, Sakurai 1985, Maekawa 1988, Sugito and Hirose 1988, Kondo 1993, Nagano-Madsen 1995, Imai 1997, Tsuchida 1997). In both Table 4.12 and Table 4.13, all the patterns with XHL have a weight below 0.5. An accented vowel is a demoting environment, but devoicing still occurs. In Table 4.16, it is clearly shown that Younger Males devoice accented vowels more than 50% of the time, which may have caught the attention of older speakers who say that younger speakers devoice accented vowels. However, one cannot conclude that younger speakers devoice more accented vowels than older speakers as claimed by recent studies because younger females tend to devoice less than older speakers. This is true in two of the three patterns (LHL and HHL), and younger females devoice the vowel in the #HL pattern only slightly more than Older Males, Middle Age Males, and Middle Age Females. However, Older Females devoice the vowel in the same pattern

more than Younger Females do, and almost as much as Younger Males do. This peculiar behavior of Older Females needs to be accounted for, since this is the only pattern in which Older Females show a similar devoicing rate to that of Younger Males, who are the biggest promoters of devoicing.

Thus, the claim that younger speakers devoice more accented vowels than older speakers is not supported. It is true that younger males devoice more accented vowels than older speakers, but it may only be a reflection of the general tendency for younger males to devoice more than older speakers. On the other hand, there is one environment where younger speakers, both males and females, devoice more than older speakers; pre-pausal low-pitched vowels. However, the percentage differences among Older, Middle Age and Younger Female respondents are rather small for the LL# pattern. More extensive study is needed to determine if there is any age difference in this particular environment.

5.1.4 Morpheme boundary

It has been argued that morpheme boundaries have a blocking effect on vowel devoicing, particularly in consecutive devoicing environments (Sakurai 1985, Vance 1987 and 1992, Kondo 1997, Tsuchida 1997). For example, Tsuchida (1997) states that "devoicing may occur across a word boundary when there is only one devoiceable vowel" (256) and gives the following examples.

(2) [kjaku̥#seN] 'passenger boat' ([kjaku] 'guest' + [seN] 'boat')

[oki̥#kaéru] 'rearrange' ([oki] 'put' + [kaeru] 'change')

[ʃimp̩#ʃúgi] 'mysticism' ([ʃímpi] 'mystery' + [ʃúgi] 'principle')

However, the last example is a case of a compound word, where both elements can be used as an independent word. In the second example, on the other hand, [oki] is a verb stem and cannot stand alone[13], i.e., it requires some other morpheme, in which sense it is a bound morpheme. Finally, in the first example, [kjaku] is an independent word, but [seN] is a bound morpheme. Thus, it is not clear what the researchers (e.g. Vance 1987, 1992, Kondo 1997, Tsuchida 1997) mean by 'a word boundary' or 'a morpheme boundary.'

The present study found that a word level boundary has a blocking effect, but not a bound morpheme boundary (cf. Tables 4.17 and 4.18). As expected, the most promoting morpheme boundary type is the morpheme-internal vowel, but the next promoting boundary type is a bound morpheme boundary. All other boundary types, i.e. pause, word boundary, and compound word boundary, demote devoicing. It is interesting that a compound word boundary demotes devoicing more strongly than a word boundary, which may not even form a grammatical unit, such as a subject and a verb, as demonstrated in Vance (1992).

The reason why a morpheme-internal vowel promotes devoicing is probably straightforward: there is less risk of being misunderstood. In English, word-final t/d deletion (Guy 1980) shows similar patterning. Within a single morpheme, the word-final t/d is more likely to be deleted than that in a multiple morpheme word; e.g. "mist" vs "missed." That is, the 't' in "mist" is more likely to

[13] It can stand alone when it is used as a conjunctive ("put (it) and ~"). However, in this usage, extra meaning is attached to the verb, namely "and", so I do not consider this as the same verb standing alone.

be deleted than the 't' in "missed" [mɪst]. The reason seems to be that if you delete the 't' in "missed," you lose morpheme information and there is a risk of confusing "miss" and "missed." Similarly, if you devoice the morpheme-internal vowel, you may be signaling it is one word, and if you don't devoice, you may be signaling that there is a word level boundary. If you devoice the vowel at a word level boundary, you may lose the information and the cluster of words may sound like a single word. Again, this is only a speculation, but is it true that both phenomena (vowel devoicing in Japanese and consonant cluster simplification in English) make the distinction between morpheme-internal and morpheme-external.

5.1.5 Consecutive devoicing

Devoicing of consecutive syllables has been reported (e.g. Sakuma 1929, Kawakami 1977, Maekawa 1988) but other studies claim it is avoided, particularly in a slower, more formal speech (e.g. Han 1962, Tsuchida 1997).

Tsuchida (1997) argues that there is a regular pattern for the possible devoicing sites; the initial two vowels are evaluated with the ranked constraints, and, after it is decided which one of the initial two is devoiced, the rest of the sequence follows an alternating pattern (cf. 2.2.5).

The present study shows, however, that devoicing is demoted in a consecutive devoicing environment even when the previous vowel is not devoiced (cf. Tables 4.21 and 4.22). The weight is higher for /i/, which is 0.423, but it is very low for /u/, which is 0.082. In the case of /u/, devoicing is more

strongly demoted when the previous vowel is not devoiced than when the previous vowel is devoiced, although the difference was very small. This seems to indicate that the speakers are subconsciously aware of consecutive devoicing before they utter the word, and, in trying to avoid it, end up not devoicing any vowels at all.

This is cognitively interesting. Morris (2003) found in her perception study of Japanese vowel devoicing that speakers of Tokyo Japanese judged a person who did not devoice the vowel in the most favorable environment for devoicing as a Tokyo speaker because they did not pay attention to the actual devoicing, but to the environment in which the vowel occurred. In other words, they did not care if the person actually devoiced the vowel or not, but, since it was in such a likely environment for devoicing, they just assumed that it was devoiced. This is counterintuitive, however, and we often hear comments which note that someone who does not devoice the high vowels in /kusa/ ('grass') and /tʃikara/ ('power') sounds like they are from Osaka or Kochi (places in the western part of Japan) (Sakuma 1929). In Tokyo Japanese, the final vowel in the utterance /hai, soo##desu/ ('Yes, it is so.') is almost categorically devoiced, and if someone does not devoice it, it gives a strange impression (Maekawa 1988). These comments indicate that people appear to recognize vowels that should be devoiced but are not. However, according to Morris (2003), this is not the case. People appear not to pay attention to the actual devoicing in the most likely environments. This is consistent with one finding of the present study. People do not pay attention to the actual devoicing of the previous vowel in a consecutive

devoicing environment, but they are aware (obviously subconsciously) of the environments and that there is a danger of consecutive devoicing. In response to that, which might result in lexical ambiguity, people tend to try to avoid the situation. This is another piece of evidence that shows the difference between prescriptive grammar and descriptive grammar. What a dictionary says and what people think they should do (or actually do) is often very different from what they do in their unmonitored, natural language use (e.g. Trudgill 1972).

5.2 Social Factors

As seen in 4.2 above, the results of the present study show variation in devoicing in terms of speech style, age and sex, and, for the vowel /u/, social class. It was confirmed that the more casual the speech style becomes, the more devoicing occurs. There is an interaction between age and sex, and younger males devoice most, younger females devoice least, and the rest fall in between.

From these patterns, it is reasonable to hypothesize that vowel devoicing in Japanese is a nonstandard feature, because younger males are often prone to be attracted to the covert prestige associated with nonstandard features, and nonstandard features usually occur in more casual speech style. Moreover, younger females are often prone to be attracted to the overt prestige associated with standard features. This may explain why younger males devoice most and younger females devoice least.

However, social class difference was also significant, at least for the vowel /u/. Middle class respondents are more likely to devoice and Working and Upper

Middle classes are less likely to devoice. This social class patterning is more like that of a standard feature, because the typical pattern of a nonstandard feature is that the lower the social class, the more frequently the nonstandard feature is used. The pattern in which Lower Middle class speakers use the feature most, and Working and Upper Class speakers don't use it as much, may indicate the linguistic insecurity of the Lower Middle class speakers, which means the feature is considered prestigious and associated with standardness. Overuse of such features by Lower Middle Classes is known as "hypercorrection" (Labov 1966).

Kroch (1978) argues that "ordinary unconscious phonological changes are ... phonetically motivated processes" (21); therefore, "non-prestige dialects tend to be articulatorily more economical than the prestige dialect" (20). The socially prestigious dialects resist these natural processes because they want to "mark themselves off as distinct from the common people" (30). If this reasoning is applied to the present case, and if vowel devoicing is a nonstandard feature, it should be more economical than non-devoicing. This seems to be articulatorily supported because phoneticians found that vowel devoicing occurs because of the glottal gestural overlap, an effort to minimize the glottal gesture, which is manifested in the sequence of a vowel and the neighboring voiceless consonants produced with a single glottal opening (Yoshioka 1981; Yoshioka, Löfqvist, and Hirose 1982; Jun and Beckman 1993; Tsuchida 1997; Fujimoto, et. al. 2002). By devoicing the vowels between voiceless consonants, the glottal gesture becomes more economical.

However, it needs to be pointed out that the phonetic outcome of the extreme case of vowel devoicing is vowel deletion, and this would be considerably less natural for Japanese because it produces consonant clusters. CV syllables are considered to be the most unmarked syllable structure, but as a result of vowel deletion, /kusa/ becomes /ksa/. Also, even when the vowel is not deleted, a devoiced vowel is more marked than voiced vowels, as indicated by the constraint **SONVOI** (sonorants are voiced; Ito, Mester, and Padgett 1995).

If it is actually the case that vowel devoicing in Japanese in a nonstandard feature, why is it considered standard to devoice certain vowels in Tokyo Japanese? Why do people make comments that the western dialects give an impression of being smooth and soft, and Tokyo dialect gives an impression of being crisp and clear, (at least partly) because vowel devoicing occurs frequently in Tokyo dialect, but very infrequently in the western dialects (Sakuma 1929)?

Maekawa (1988) also acknowledges that there is a certain social measure (probably standardness) in vowel devoicing in Japanese, because 1) there are certain vowels, such as the final vowel in /desu/ (polite copula) in sentence-final position, which must be devoiced, and when they are voiced, it gives a strange impression, 2) in a consecutive devoicing environment, only certain patterns are actually used out of possible combinations of devoiced and voiced vowels, and if the speaker does not use one of the possible patterns, that also gives a strange impression, and 3) Japanese vowel devoicing is actively (but still unconsciously) controlled by the speakers because of the "positive effort of widening of the glottis for the devoiced vowel segment" (Sawashima 1971, cited in Maekawa

1988). This "strange impression" gives rise to a social standard because it does not interfere with communication or semantic meaning of the utterance, but it reveals such speaker information as region, age, sex, and even emotional state (Maekawa 1988). Maekawa argues that this is not the case with the vocalization of /h/ intervocalically, which is a feature that also shows variation. If the speaker does not vocalize /h/, it does not give a strange impression. Therefore, Maekawa (1988) argues that vowel devoicing has a social standard, which the vocalization of /h/ does not have.

It is not clear, however, that the "strange impression" is related to "standardness" because it could be only a regional difference. In short, we don't know if it has social meaning other than region, although region is not completely isolated from standardness in Japanese. However, Sakuma (1929)'s comments that, if someone does not devoice the high vowels in a devoicing environment, they sound like they are from somewhere in the western part of Japan, gives an impression that he considers those people in the western part to be nonstandard speakers or "hillbillies", people who do not know how to speak "properly." So far, then, vowel devoicing shows linguistic characteristics of a nonstandard feature, but, according to people's perception, it is a standard feature.

Thus, speech style and sex/age patterns suggest that vowel devoicing in Japanese may be a nonstandard feature, and articulatory data seems to support this: a glottal gesture becomes more economical by devoicing. However, Japanese speakers' general perception and prescriptive authority suggest

otherwise: it is a standard Tokyo feature, and the social class pattern (at least for the vowel /u/) seems to support this.

5.3 Summary

The present study has confirmed previous studies regarding the influence of preceding and following consonants: preceding fricatives promote devoicing most, then affricates, and stops demote it; following stops promote devoicing most, then affricates, and fricatives demote it. However, the behavior of [ʃ] and [p] does not conform to the general picture; they both demote devoicing. It was suggested that this might be because they do not have full status as phonemes, and vowel devoicing is demoted next to a weak status phoneme. It was also found that a low-pitched vowel before a pause is a robust promoting environment for devoicing, more so for the vowel /i/ than /u/. The behavior of affricates in devoicing environments was also examined, and it was argued that the present study supports the traditional view of affricates, which is that affricates are a combination of a stop and a fricative.

Vowel identity was also found to be a significant factor in vowel devoicing in Japanese. The vowel /i/ is more likely to devoice than the vowel /u/, an important finding since the forms /desu/ and /masu/, which are nearly categorically devoiced in Tokyo speech, did not provide enough data to overcome the higher probability for /i/ devoicing.

As for accent, it was found that the pitch associated with the vowel, rather than the accent itself, is more important. Low-pitched vowels are more likely to

devoice than high-pitched vowels. Moreover, it was found that accent has an influence on vowel devoicing in Japanese, and accented vowels do demote devoicing, although it is true that accented vowels do undergo devoicing quite frequently. Furthermore, there may be an age difference in the environment of pre-pausal low-pitched vowel, where younger speakers uniformly devoice more than older speakers. However, age difference in the devoicing of accented vowels was not supported in the present study.

Morpheme boundary was also found to be a significant factor; a word level boundary demotes devoicing, particularly, a compound word boundary. However, a bound morpheme boundary does not demote devoicing, it actually promotes it.

One peculiar finding of this study is that in a consecutive devoicing environment, devoicing is demoted even though the previous devoiceable vowel is not actually devoiced. As a result, both vowels tend to be voiced, and this suggests that speakers have considerable sensitivity to the weight of devoicing environments.

It was argued that social factors show a mixed pattern regarding standardness. Speech style, age/sex patterns, and articulatory data suggest that devoicing may be nonstandard, but the social class pattern (for /u/), speakers' perception, and prescriptive authority (e.g. dictionaries) suggest it is a standard feature.

In the first chapter, I mentioned that the focus of this study is not to determine whether vowel devoicing is a phonological or phonetic process, but I made several phonological references in my discussion above. In the following

chapter, I will try to account for the mixed pattern of social factors, by making reference to the phonology/phonetics distinction made by Tsuchida (1997), introduced in Chapter 2, although I will take other approaches to this problem as well and make some final suggestions for further research.

CHAPTER 6

CONCLUSION

The present study has investigated vowel devoicing in the Tokyo dialect quantitatively by collecting a substantial amount of data, looking at various linguistic and social factors, and using a sophisticated statistical program. Although its primary purpose was to uncover social meaning, it was also hoped that an investigation of such a large data set would provide supplementary information on previously studied linguistics factors. By using this method, I have in fact reached some findings that are not reported in previous studies and have added more evidence concerning some controversial issues; [ʃ] and [p] behave differently from other obstruents; the vowel /i/ promotes devoicing, whereas /u/ demotes it; accent demotes devoicing; a word boundary also demotes, and devoicing is demoted in a consecutive devoicing environment, regardless of the voicing of the previous vowel. Since the amount of data collected is very large, it is more reliable than most earlier studies, which used only limited data. In addition, analyses using the sophisticated statistical program, Goldvarb, make this study even more reliable in determining the significant factors influencing vowel devoicing in Japanese.

As outlined in the previous chapter, the analysis of social factors faces a problem; there is a mixed pattern in terms of standardness. Style and age/sex patterns suggest that devoicing is a nonstandard feature, and social class patterns and speakers' perceptions, as well as prescriptive authority, suggest the

contrary. I will propose several possible accounts for this mismatch in the following subsections.

6.1 Phonological vs. phonetic devoicing and standardness

One possible answer to the question "How can a feature behave like a nonstandard feature, but be considered standard?" may be that native Japanese speakers consider vowel devoicing in Japanese as a standard, but there may be a subtle quantitative requirement, one which interacts with the various weighted environments. One of my respondents told me during the interview that younger people these days don't pronounce the end of sentences clearly, and it annoys him. He doesn't consider it appropriate. He gave an example of a pastor at his church, who is in his 40's and from Kyushu (the southern island). He speaks fast and devoices a lot of vowels at the end of the sentences.

This perception might be related to the phonological and phonetic devoicing that Tsuchida (1997) suggests. Phonological devoicing may be considered standard, but phonetic devoicing may be nonstandard, perhaps even causing ambiguity in speech as a result of consonant cluster homophone formation and less clarity overall. Thus, young male speakers devoice most because of the covert prestige attached to the nonstandardness of phonetic devoicing, and younger females devoice least by adopting only phonological devoicing because of the overt prestige associated with it, and avoiding phonetic devoicing. (Younger females are more prestige-oriented because they have not established their social status yet, as I discuss in more detail below.)

If this is the case, maintaining a certain level of devoicing is a highly monitored albeit unconscious process. In Kroch's terms, it may be a feature selected by the prestige group of speakers to mark themselves off.

6.2 Language change among younger speakers

Another possible explanation for this uncommon patterning of social factors may be that it reflects gender differences among younger speakers, at least for the sex and age interaction pattern. Japanese has considerable gender differences at all levels of language (Shibamoto 1985, Haig 1990, Ide and McGloin 1990, Okamoto 1995, Ide 1997, Ide and Yoshida 1999) and is particularly well-known for sentence final particle differences (e.g. McGloin 1990, Okamoto 1995). However, it has been reported that gender differences are lessening among younger speakers. Okamoto (1995) shows that younger female speakers actually use more masculine sentence-final forms than feminine ones. If this is the case and if younger male and female speech are becoming similar in terms of some linguistic features, such as sentence-final particles, it is possible to hypothesize that younger people may try to express gender differences in another form. This could be manifested in their use of vowel devoicing; less devoicing is feminine, and more devoicing is masculine. This differentiation does not extend to older age groups because they still maintain the traditional gender differences in other areas. This might explain the large difference between men and women among Younger speakers, but rather small differences among Middle Age and Older speakers.

On the other hand, the speech style pattern may be accounted for on purely phonetic grounds. Since vowel devoicing is caused by glottal gestural overlaps, the faster the speech becomes, the more overlaps occur. However, this cannot exclusively account for social class patterning, for Lower Middle class speakers devoice more than other classes.

The social class classification used in this study followed the criteria used in sociolinguistic studies in the U.S. (e.g., Labov 1966; Shuy, Wolfram, and Riley 1968; among others) using socioeconomic scores, as outlined in Warner's Index of Social Status (1960). In Japan there are no previous sociolinguistic studies that use social class as a factor, except for those that used the *yamanote* (uptown)/*shitamachi* (downtown) distinction (e.g. Hibiya 1995). Although it seems reasonable to assume that the same criteria apply to the socioeconomic situation in Japan as in the US, the treatment is not established in the field. Furthermore, it may be the case that different factors, which were not used in the present study, play a significant role in determining socioeconomic status in Japan.

The fact that I did not obtain any clear social status differences in the present study may mean that the social class criteria I used are not entirely accurate for measuring social status in Japan. It may also mean that vowel devoicing in Japanese is not strongly related to social class differences. In any case, we need more extensive studies of social status in Japan as it relates to variable linguistic phenomena.

6.3 Language change and phonological/phonetic devoicing

By looking at the patterning of social factors more closely, it is possible to combine the above two possibilities. The gender differences among younger speakers might suggest language change or an age-grading differentiation. If phonetic vowel devoicing is considered nonstandard, older speakers may not use that feature as much because they tend to embrace conservative prescriptive values and to use more standard features. Middle Age speakers may be more lax in this restriction, since they are younger and perhaps slightly less conservative or do not rely on this linguistic feature to show their standardness; therefore, they use more of the feature in question, i.e. phonetic devoicing. Since Younger speakers have not established their status yet, female speakers devoice less so that they sound more standard, or prestigious, by avoiding phonetic devoicing, but male speakers opt for the covert prestige of the feature: young people's (or male) speech. Thus, the mixed pattern observed in the present study reflects a combination of language change in the gender differences among Younger speakers and the standard/nonstandard distinction based on the status of the devoicing: phonological or phonetic.

The mixed pattern, which seems difficult to account for, may be in part accounted for by adopting the notion that there is both phonological and phonetic devoicing, as Tsuchida (1997) argues. Previously, phonetic devoicing may have been regarded as nonstandard; therefore, males devoice more than females in general, but the gender differences among Middle Age and Older speakers are relatively small, because gender is not marked by this feature. However, younger

males may have developed this distinction and started to devoice more as a sign of covert prestige attached to young people's speech. Then young females may have interpreted that as masculinity and started devoicing less than their male counterparts to indicate femininity and to compensate for the features that have lost gender differences, such as sentence-final particles.

6.4 Variationistic quantitative approach

It is also possible to look at this patterning from a purely variationist point of view. On this view, vowel devoicing in Japanese carries a dual meaning — standard and nonstandard. Standard vowel devoicing is signaled by the right amount of devoicing, not too much, not too little. According to Labov, nasality shows a similar distinction.

> Frequently, if you ask somebody what he thinks of this style of speech (nasalized), he'll say it's very "nasal"; and if you produce a speech of this sort (denasalized), he'll say that's very "nasal" too. In other words, the denasalized speech characteristics of some urban areas and extremely nasalized speech are treated in the same way. (Labov, discussion of Hoenigswald 1966:23-4)

In order to be considered standard, one has to have the right amount of nasality. If there is too much nasality, they are called 'nasal'; if there is too little nasality, they are also called 'nasal', even though the right term may be 'denasalized'. Another view of Labov's observation is that excessive nasality or lack of nasality both result in nonstandardness. Similarly, excessive devoicing or lack of

devoicing results in nonstandardness in the case of Japanese vowel devoicing. If someone does not devoice enough, they are considered a speaker of a different dialect (probably from the western part of Japan), and if someone devoices considerably more, they are considered nonstandard within the Tokyo dialect and associated with young or masculine speakers because of the new identity attached to the feature among youth. This may be why young male speakers devoice most, young females devoice least, and the rest fall in between, with males devoicing slightly more than females in the same age group.

6.5 Summary and further study suggestions

I have proposed two possible accounts for the social patterns found in this study, in which vowel devoicing seems to show both standard and nonstandard behavior. In both accounts, standardness is related to the right amount of devoicing and nonstandardness is related to excessive devoicing (in the Tokyo dialect).

In one account, the right amount of devoicing is based on the phonetic/phonological distinction proposed by Tsuchida (1997). Phonological devoicing is standard and phonetic devoicing is nonstandard. In the other account, the right amount of devoicing may be somewhere in between the young males and young females, closer to that of Middle Age and Older speakers. In any case, the maintenance of the right amount of devoicing may be the standard feature that is picked up by the prestige group of speakers, according to Kroch (1978).

In order to show that the phonological vs. phonetic devoicing is the reason for this mixed patterning, we need to investigate what exactly constitutes phonological and phonetic devoicing. The present study supported some of Tsuchida's (1997) claims (e.g. devoicing before allophones of /h/ is pohonologically prohibited) but not others (e.g. devoicing between two fricatives is phonologically prohibited). This may be a difficult task because we would have to develop stringent tests to show the line between phonology and phonetics.

In order to show that it is the amount of devoicing that determines the standard value of devoicing, we need to know what exactly the right amount of devoicing is. Is it the amount used by younger females that is considered most standard, because they are certainly not considered nonstandard, although their usage shows very low frequency? Is it the amount used by Middle Age speakers, because they seem to be most sensitive to the standard feature in many sociolinguistic studies? A carefully planned, and manipulated, perceptional study of vowel devoicing might be able to tease out some of these classifications.

Finally, as mentioned in 6.2, more sensitive and locally applicable study of social status in Japan is definitely needed. Is the *yamanote* (uptown)/*shitamachi* (downtown) distinction still valid, and is it the only valid distinction? Are there other factors that play a significant role in determining social status in Japan? Is it at all possible to determine a uniform scale to cover all age groups because of the rapidly changing society of younger speakers? These questions should be pursued in order to better understand the social meaning of Japanese vowel devoicing and the social structure of the Japanese language as a whole.

The present study is the first attempt to investigate Japanese vowel devoicing in a variationist framework, using the common social factors used in many variationist studies, including socioeconomic status. I hope this work will help provide a basis for further sociolinguistic studies of vowel devoicing and the Japanese language in general.

APPENDICES

APPENDIX A

Table A-1: Word List

No.	word/phrase	Vl	pre. C	foll. C
1	tookyoo#eki#no#shihatsuressha	i	9	n
		i	1	7
		a	7	4
		u	4	r
		a	1	11
2	kippu#hanbaiki	i	9	10
		u	10	7
		i	9	11
3	kusatsu#e#iku#kisha	u	9	2
		a	2	4
		u	9	9
		i	9	1
		a	1	11
4	shuppatsu#suru	u	1	10
		a	10	4
		u	4	2
		u	2	r
5	kitsutsuki#ga#ki#o#tsutsuku#oto	i	9	4
		u	4	4
		u	4	9
		i	9	g
		u	4	4
		u	4	9
		o	8	11
6	kakashi	a	9	9
		a	9	1
		i	1	11
7	natsu	u	4	11
8	toohoku#chihoo	o	7	9
		u	9	3
		i	3	7
9	susuki	u	2	2
		u	2	9
		i	9	11
10	nishi	i	1	11
11	gifu	u	6	11
12	higashi#hankyuu	i	1	g
		i	1	7

Table A-1 (cont'd)

No.	word/phrase	Vl	pre. C	foll. C
13	chifusu	i	3	6
		u	6	2
		u	2	11
14	chihyoo	i	3	5
15	ejiputo#no#sufinkusu	u	10	8
		u	2	6
		u	9	2
		u	2	11
16	massuguna#chiheesen	u	2	g
		i	3	7
17	ookisa	i	9	2
		a	2	11
18	hisashiburi#no#hicchihaiku	i	5	2
		a	2	1
		i	1	b
		i	5	3
		i	3	7
		u	9	11
19	Jaru#no#suchuwaadesu	u	2	3
		u	2	11
20	yasui#kippu	i	9	10
		u	10	11
21	suupaa#no#shishokuhin	i	1	1
		o	1	9
		u	9	5
22	oishikute#hoppeta#ga#ochisoo#na#okashi	i	1	9
		u	9	8
		e	8	7
		o	7	10
		e	10	8
		i	3	2
		a	9	1
		i	1	11
23	sushimeshi	u	2	1
		i	1	m
		i	1	11
24	kohitsuji	o	9	5
		i	5	4
		u	4	j
25	sukiyaki#wa#gochisoo#da	u	2	9
		i	3	2

Table A-1 (cont'd)

No.	word/phrase	VI	pre. C	foll. C
26	shoohisha#no#shuchoo	i	5	1
		u	1	3
27	ishiki#choosa	i	1	9
		i	9	3
		a	2	11
28	fusoku	u	6	2
		o	2	9
		u	9	11
29	futsuu#no#shufu	u	6	4
		u	1	6
		u	6	11
30	pishari#to#shimeru	i	10	1
		o	8	1
		i	1	m
31	seekatsuhi#o#kasu	a	9	4
		u	4	5
		a	9	2
		u	2	11
32	fukoo#na#futari	u	6	9
		u	6	8
33	gin#no#supuun	u	2	10
34	himitsu#shugi	i	5	m
		u	4	1
		u	1	g
35	fuhoo#nyuukoku	u	6	7
		o	9	9
		u	9	11
36	gakeppuchi	e	9	10
		u	10	3
		i	3	11
37	rekishiteki#haikei	i	9	1
		i	1	8
		e	8	9
		i	9	7
38	seefu#hihan	u	6	5
		i	5	7
39	fufuku#o#mooshitateru	u	6	6
		u	6	9
		i	1	8
		a	8	8

Table A-1 (cont'd)

No.	word/phrase	VI	pre. C	foll. C
40	chishiki	i	3	1
		i	1	9
		i	9	11
41	shifuku#no#kookoo	i	1	6
		u	6	9
		u	9	n
42	samui#shichookakushitsu	i	1	3
		a	9	9
		u	9	1
		i	1	4
		u	4	11
43	asa#hayaku#okita	a	2	7
		i	9	8
		a	8	11
44	tokee#ga#pipi#tto#naru	o	8	9
		i	10	10
		i	10	8
45	tsukue#no#ue#o#yoku#fuku	u	4	9
		u	9	6
		u	6	9
		u	9	11
46	shutaiteki	u	1	8
		e	8	9
		i	9	11
47	kachitsuzukeru#ureshisa	a	9	3
		i	3	4
		u	4	z
		i	1	2
		a	2	11
48	enpitsu	i	10	4
		u	4	11
49	sansuu#no#kuku	u	9	9
		u	9	11
50	chichi#to#haha	i	3	3
		i	3	8
		o	8	7
		a	7	7
		a	7	11
51	gorufu#no#uchippanashi	u	6	n
		i	3	10
		i	1	11
52	ichi#kara#hajimeru	i	3	9

Table A-1 (cont'd)

No.	word/phrase	Vl	pre. C	foll. C
53	omoikitte#hipparu	i	9	8
		e	8	5
		i	5	10
54	haha#no#hi	a	7	7
		i	5	11
55	oshite#kudasai	i	1	8
		e	8	9
		u	9	d
56	kasu#hoo#ga#ii	a	9	2
		u	2	7
57	kashitsuki	a	9	1
		i	1	4
		u	4	9
		i	9	11
58	kachi	a	9	3
		i	3	11
59	hifu	i	5	6
		u	6	11
60	fushin	u	6	1
61	shutsubotsu#suru	u	1	4
		u	4	b
		u	4	2
		u	2	r
62	kojinteki#higai	e	8	9
		i	9	5
		i	5	g
63	ishiki#fumee#no#kyooaku#han	i	1	9
		i	9	6
		u	6	m
		u	9	7
64	hokori#o#suteru	o	7	9
		u	2	8
65	kyohi#hannoo	i	5	7
66	putsuri#to#kireru	u	10	4
		u	4	r
		o	8	9
		i	9	r
67	jippi#seekyuu	i	10	2

Table A-1 (cont'd)

No.	word/phrase	Vl	pre. C	foll. C
68	sakana#ga#ippiki#pichipichi#haneru	a	2	9
		i	10	9
		i	9	10
		i	10	3
		i	3	10
		i	10	3
		i	3	7
69	pita#tto#tomaru	i	10	8
		a	8	8
		o	8	8
70	ibento#no#shusaichi#o#utsusu	u	1	2
		u	4	2
		u	2	11
71	hanasu#hito	u	2	5
		i	5	8
		o	8	11
72	paathii#no#shuhin	u	1	5
73	shushoo	u	1	1
74	akushu	u	9	1
		u	1	11
75	hihyoo	i	5	5
76	matsu#hoo#wa#taihen#da	u	4	7
77	sanpi	i	10	11
78	hikakuteki#takai#chiteki#suijun	i	5	9
		a	9	9
		u	9	8
		e	8	9
		i	9	8
		a	8	9
		i	3	8
		e	8	9
		i	9	2
79	otaku#ppoi#fuchidori#megane	a	8	9
		u	9	10
		u	6	3
		i	3	d
80	mezurashii#shuhoo#no#hinshu#kairyoo	u	1	7
		u	1	9
81	tsuchi	u	4	3
		i	3	11
82	kaihatsu#fukanoo	a	7	4
		u	4	6
		u	6	9

Table A-1 (cont'd)

No.	word/phrase	Vl	pre. C	foll. C
83	shippai#o#kakusu#tsumori	i	1	10
		a	9	9
		u	9	2
		u	2	4
		u	4	m
84	hinshitsu#kanri	i	1	4
		u	4	9
85	tsutaeru	u	4	8
86	ookikute#udeppushi#ga#tsuyoi	i	9	9
		u	9	8
		u	10	1
		i	1	g
87	pukupuku#shita#te	u	10	9
		u	9	10
		u	10	9
		u	9	1
		i	1	8
		a	8	8
		e	8	11
88	pikapika#no#kutsu	i	10	9
		a	9	10
		i	10	9
		u	9	4
		u	4	11
89	chiisana#kutsushita	u	9	4
		u	4	1
		i	1	8
		a	8	11
90	kokoro	o	9	9

APPENDIX B

Reading Passage (Japanese)

美智子(みちこ)さんは、毎日(まいにち)、朝早(あさはや)く起(お)きます。目覚(めざま)し時計(どけい)がピピ(ぴぴ)っと鳴(な)るのは6時(じ)です。朝(あさ)、会社(かいしゃ)に行(い)くと、机(つくえ)の上(うえ)を良(よ)く拭(ふ)きます。上司(じょうし)はお宅(たく)っぽい縁取(ふちど)りめがねをかけた人(ひと)です。美智子(みちこ)さんは自分(じぶん)の失敗(しっぱい)を隠(かく)すつもりはありませんが、時々(ときどき)上司(じょうし)の失敗(しっぱい)も自分(じぶん)のせいにされるのがいやです。趣味(しゅみ)はゴルフ(ごるふ)の打(う)ちっぱなしです。いつも会社(かいしゃ)帰(かえ)りに買(か)い物(もの)をします。スーパー(すーぱー)の試食品(ししょくひん)が大好(だいす)きです。好(す)きな食(た)べ物(もの)は寿司飯(すしめし)とすき焼(や)きです。美智子(みちこ)さんが子供(こども)のころ、すき焼(や)きはご馳走(ちそう)でした。夢(ゆめ)は普通(ふつう)の主婦(しゅふ)になることです。政府批判(せいふひはん)と消費者(しょうひしゃ)の主張(しゅちょう)は大切(たいせつ)だと思(おも)っているので、意識調査(いしきちょうさ)には良(よ)く協力(きょうりょく)します。珍(めずら)しい手法(しゅほう)の品種改良(ひんしゅかいりょう)は必要(ひつよう)ないと思(おも)っています。昨日(きのう)魚屋(さかなや)に行(い)ったら、魚(さかな)が一匹(いっぴき)ピチピチ(ぴちぴち)は跳(は)ねていました。最近(さいきん)カルシウム(かるしうむ)が不足(ふそく)していると思(おも)ったので、買(か)ってきました。帰(かえ)りに啄木鳥(きつつき)が木(き)をつつく音(おと)が聞(き)こえました。隣(となり)のアパート(あぱーと)には大きくて腕(うで)っ節(ぷし)が強(つよ)そうな外国人(がいこくじん)が住(す)んでいます。美智子(みちこ)さんは外国(がいこく)に行(い)ったことがありません。留学(りゅうがく)したかったのですが、私費留学(しひりゅうがく)はとても無理(むり)なので不本意(ふほんい)ながら就職(しゅうしょく)しました。エジプト(えじぷと)のスフィンクス(すふぃんくす)を見(み)るの

こども　　ゆめ　　ジャル　すちゅわーです　ともだち
が子供のころからの夢です。JALのスチュワーデスの友達がいるので、ど
やす　きっぷ　て　い　　えじぷと　い　　おも
うにかして安い切符を手に入れて、エジプトに行きたいと思っています。
ちふす　こわ　　ことし　とうほくちほう　りょこう　よてい
チフスも怖くありません。でも、今年は　東北地方　を　旅行　する予定です。
えじぷと　　ちへいせん　　とうほくちほう　すすき
エジプトのまっすぐな地平線もいいですが、　東北地方　のススキもいいでしょう。

APPENDIX C

Table A-2: Neighborhood Scores

	Neighborhood	Score
1	Adachi-ku	1
2	Arakawa-ku	1
3	Edogawa-ku	2
4	Taitoo-ku	2
5	Ikebukuro (Toshima-ku)	2
6	Sugamo (Toshima-ku)	2
7	Kootoo-ku	2
8	Takasago (Katsushika-ku)	2
9	Itabashi-ku	2
10	Takadanobaba (Shinjuku-ku)	2
11	Nishi-Tookyoo-shi	3
12	Komagome (Toshima-ku)	3
13	Chihaya (Toshima-ku)	3
14	Shibamata (Katsushika-ku)	3
15	Kawasaki-shi (Kanagawa)	3
16	Shinbashi (Minato-ku)	3
17	Nerima-ku	3
18	Asakusa (Chuuoo-ku)	4
19	Minato-ku	4
20	Nakano-ku	4
21	Ishikawadai (Oota-ku)	4
22	Kitami (Setagaya-ku)	4
23	Bunkyoo-ku	4
24	Suginami-ku	4
25	Chiyoda-ku	4
26	Mitaka-shi	4
27	Yokohama-shi (Kanagawa)	4
28	Shibuya-ku	5
29	Mejiro (Toshima-ku)	5
30	Meguro (Oota-ku)	5

APPENDIX D

Table A-3: Socioeconomic Scores

Age Group	Sex	Age	Occupation	x2	Education	x2	Neighborhood	Total
Y	Male	22	1	2	1	2	1	5
M	Female	61	1	2	1	2	2	6
Y	Male	24	1	2	1	2	2	6
Y	Male	28	1	2	1	2	3	7
Y	Male	27	1.5	3	1	2	2	7
M	Male	60	2	4	1	2	2	8
O	Male	62	1	2	1	2	4	8
Y	Male	28	1.5	3	1	2	3	8
Y	Male	25	1	2	2	4	2	8
M	Female	35	2	4	2	4	1	9
O	Female	87	2	4	1	2	3	9
O	Female	76	2	4	1	2	3	9
O	Male	65	2	4	1	2	3	9
Y	Male	24	1	2	1	2	5	9
Y	Male	26	1.5	3	2	4	2	9
M	Female	60	3	6	1	2	2	10
M	Male	54	2	4	2	4	2	10
O	Male	60	2	4	1	2	4	10
O	Male	78	3	6	1	2	2	10
Y	Female	27	2	4	2	4	2	10
O	Female	70	3	6	1	2	3	11
Y	Female	29	3	6	1	2	3	11
M	Male	36	3	6	1	2	3	11
M	Female	35	3	6	2	4	4	14
Y	Male	20	3	6	2	4	4	14
Y	Male	19	2	4	4	8	2	14
M	Male	33	1.5	3	4	8	4	15
Y	Female	25	3	6	3	6	3	15
Y	Male	26	2	4	4	8	3	15
M	Male	61	3	6	4	8	2	16
O	Female	84	3	6	3	6	4	16

Table A-3 (cont'd)

Y	Female	20	3	6	4	8	2	16
Y	Male	21	2	4	4	8	4	16
M	Female	43	3	6	3	6	5	17
M	Female	34	3	6	4	8	3	17
M	Male	40	3	6	4	8	3	17
M	Male	61	3	6	4	8	3	17
O	Female	79	3	6	3	6	5	17
O	Female	62	3	6	4	8	3	17
Y	Female	19	3	6	4	8	3	17
M	Female	58	4	8	4	8	2	18
O	Male	62	4	8	4	8	2	18
Y	Male	19	3	6	4	8	4	18
M	Male	30	4	8	4	8	3	19
Y	Female	15	3	6	4	8	5	19
Y	Female	24	4	8	4	8	3	19
Y	Female	28	3	6	4	8	5	19
M	Female	33	4	8	5	10	2	20
M	Male	37	4	8	4	8	4	20
Y	Female	19	4	8	4	8	4	20
Y	Male	24	4	8	4	8	4	20
Y	Male	25	3	6	5	10	4	20
M	Male	35	4	8	5	10	3	21
O	Male	80	5	10	4	8	3	21
Y	Male	15	4	8	4	8	5	21
M	Female	42	5	10	4	8	5	23
Y	Female	16	5	10	4	8	5	23
Y	Male	15	5	10	4	8	5	23

APPENDIX E

Sample transcription of an interview conversation (excluding interviewer's part)

Counter #	Tokens
23-25	ima de ieba, kankoku no, .. souru desu.
29-33	eeto issai .. n:: ni-juu-..nen desu yo ne: shuusen, shuusen de: modotte kimashita no de: .. maa, i .. ni-sai desu ne, ni-sai chikaku desu ne, hai
34-35	hai soo desu.
36-37	soo da to omoimasu, hai.
38-39	(so)datta basho wa, tookyoo desu
39-40	e:: watakushi wa suginami:-ku desu
42-43	tookyoo no itabashi-ku desu.
44-49	itabashi-ku to itte mo honto ni mina, minami-choo juusho ga minami-choo nandesu ga:, honto ni .. itabashi-ku no hazure .. moo sugu .. dooro ip-pon de toshima-ku .. to yuu tokoro nanode:, n:: itabashi-ku to ittemo .. n: ikebukuro, kara sugu desu shi,
49-51	moyori no eki wa: kanamechoo:: desu ne: ..... soo desu ne:
51-52	ichi-ban chikai no wa kanamechoo
52-54	aruite .. juu .. juu-go-hun .. kakaranai .. gurai kana::
54-55	chikai desu, dakara itsumo: jitensha
57-62	ikebukuro-eki made demo ni-jup-pun tarazu desu kara: .. ne:: dakara::, hai, benri-na toko ni, itabashi-ku tte yuuto minna itabashi no hazure no hoo to yuu ka, un: saitama ni chikai hoo o soozoo sareru kamo shirenai ndesu ga: honto ni moo toshima-ku .. sugu tonari ga toshima-ku to yuu
64-65	go-juu-has-sai de:su.
67-83	soo desu ne:, shufu, de, e:, desu keredomo:, ima ano .. boranthia, katsudoo to iimasu ka:, sore no, ano guruupu ni haitte mashite:, de, ano, jiritsu-shien saabisu to iu koto de:, e:: .. roojin-kaigo toka:, sorekara .. e:: .. okaasan, ikuji: no, okaasan no: soyu, sapooto to yuu yoona, shigoto ... shitemashite enupiioo hoojin ni, narimashita node:, ano jibun-tachi de, honto ni, shigoto ..... ano jimu-teki na (koto kara nani kara) zenbu jibun-tachi: de: yattemasu node, (hh) ano, boranthia no honto no, soo yuu shigoto to, sorekara jimu-teki na shigoto tte yuu kana? hoojin to shite no shigoto o, ryoohoo yattemasu node kekkoo isogashiku, hanbun, shigoto mitai ni nattemasu.
83-84	soo desu ne:, un
84-85	e::to mada ni-nen tarazu desu kedo:
85-87	chotto maa, kodomo-tachi mo .. nee futari kekko(hh)n shimashita shi:
87-88	eriko to mariko a:: masahiro ga kekkon shita nde:

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