

Research Article

Sound Change in The Japanese Numeral Quantifiers

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Abstract

This research deals with the sound change of Japanese numeral quantifiers. The data were collected through observation and interview Japanese native speakers. The data were identified in order to investigate which numerals have the potential to undergo some sound change. They were then analyzed phonemically and some phonetically as well. The data analysis focused on the segmental elements and it was conducted synchronically. The results show that there are some processes of and reasons underlying the sound change in the Japanese numeral quantifiers. The most common process of the sound change is assimilation, especially regressive assimilation. Meanwhile, the reasons underlying the sound change are the presence of sound co-articulation, phonotactics in Japanese that prevents any consonant clusters except /QC/ and /NC/, devoicing of high vowel /i/, and to comply with the construction of similar numerals.

Keywords: Japanese; numeral quantifiers; sound change

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1. Introduction

In the Japanese language, when counting or specifying the amount of a noun, a quantifier is required to categorize the noun that is being counted or tallied (Kishida, 1997:13). The use of this quantifier is obligatory as suggested by Mano (2012:620) in data (1) as follows.

- (1) a. **ni*-{*inu*/*kuruma*}
2-dog/car
'two dogs/cars'
- b. *ni-hiki-no-inu/ni-dai-no-kuruma*
2-Quantifier-Particle Postposition-
dog/2-Quantifier-Particle
Postposition-car
'two dogs / two cars'

Data (1) demonstrates that it is not possible to directly say **ni inu* 'two dogs'

and **ni kuruma* 'two cars' when one intends to state 'two dogs' and 'two cars'. In order to do that, the quantifier *hiki* 'for counting small animals' and *dai* 'for counting cars and machineries' need to be attached after the said numeral so that the two form the numeral quantifiers above, namely *nidai* 'two units' in *nidai (no kuruma)* 'two units' (of car) and *nihiki* 'two small-sized animals' in *nihiki (no inu)* 'two' (dogs).

In the Japanese language's quantifier system, *hiki* is used to specify that the noun being counted or tallied refers to relatively small-sized animals with a tail such as *inu* 'dog', *neko* 'cat', and *sakana* 'fish' (Iida, 2004:379-380). As for the quantifier *dai*, it is used to specify that the noun being counted or tallied refers to a

machinery such as *kuruma* ‘car’, *jiten sha* ‘bicycle’, and *kamera* ‘camera’ (Yamamoto and Keil, 2000:381).

For numerals 1 to 10 followed by the two quantifier above, the numeral

quantifiers for each of the number are presented in Table 1.

Table 1 Constructions of Numeral 1 to 10 followed by the Quantifier *hiki* and *dai*

No	Numeral	Numeral + ~ <i>hiki</i> / <i>hiki</i> /, [<i>çiki</i>]	Numeral + ~ <i>dai</i> / <i>dai</i> /
1	<i>ichi</i> /içi/	<i>ippiki</i> /iQpiki/	<i>ichidai</i> /içidai/
2	<i>ni</i> /ni/	<i>nihiki</i> /nihiki/	<i>nidai</i> /nidai/
3	<i>san</i> /saN/, [sãN:]	<i>sanbiki</i> /saNbiki/, [sãm :biki]	<i>sandai</i> /saNdai/
4	<i>shi</i> /ši/, <i>yon</i> /yoN/	<i>yonhiki</i> /yoNhiki/	<i>yondai</i> /yoNdai/
5	<i>go</i> /go/	<i>gohiki</i> /gohiki/	<i>godai</i> /godai/
6	<i>roku</i> /roku/	<i>roppiki</i> /roQpiki/, <i>rokihiki</i> /rokihiki/	<i>rokudai</i> /rokudai/
7	<i>shichi</i> /šiči/, <i>nana</i> /nana/	<i>shichiki</i> /šičihiki/, <i>nanahiki</i> /nanahiki/	<i>shichidai</i> /šičidai/, <i>nanadai</i> /nanadai/
8	<i>hachi</i> /hači/	<i>happiki</i> /haQpiki/ <i>hachihiki</i> /hačihiki/	<i>hachidai</i> /hačidai/
9	<i>ku</i> /ku/, <i>kyuu</i> /kyuH/	<i>kyuuhiki</i> /kyuHhiki/	<i>kudai</i> /kudai/, <i>kyuudai</i> /kyuHdai/
10	<i>juu</i> /juH/	<i>juppiki</i> /juQpiki/, <i>jippiki</i> /jiQpiki/	<i>juudai</i> /juHdai/

Based on Table 1, it can be observed that there are three pairs of Japanese numerals that respectively indicate similar meaning, *shi* and *yon* ‘four’, *shichi* and *nana* ‘seven’, and *ku* and *kyuu* ‘nine’. However, not all those numerals can be followed by the quantifier *hiki* and *dai*. Moreover, some of the numeral quantifiers produced by *hiki* undergo sound change, while all of the numeral quantifiers produced by *dai* observed no sound change of any kind. Sound change refers to the existence of two or more variants in a paradigmatic relationship (Kridalaksana, 2008:12). Therefore, sound change may be defined as the existence of two phonological variants or more in the numeral quantifiers(s) produced.

Sound change can be observed, among others, by examining the existence of the (geminate obstruent) phonemic cluster /Qp/, which is apparent in the combination of its two original words,

namely *ippiki* /iQpiki/ ‘one small animal’, *roppiki* /roQpiki/ ‘six small animals’, *happiki* /haQpiki/ ‘eight small animals’, and *juppiki* /juQpiki/ and *jippiki* /jiQpiki/ ‘ten small animals’. In addition, sound change can also be observed in the changing of the quantifier’s initial phoneme form, as indicated in the voiceless glottal fricative consonant phoneme /h/ from *hiki* /hiki/ that changes into a voiced bilabial stop consonant phoneme /b/ in *sanbiki* /saNbiki/ ‘three small animals’ but not occur in *yonhiki* /yoNhiki/ ‘four small animals’.

Since sound change can only occur with certain quantifiers following certain numerals, this is an interesting topic that warrants further analysis. In Table 1.1 above, the particular quantifier is *hiki* /hiki/ and the particular numerals are *ichi* /içi/ ‘one’, *san* /saN/ ‘three’, *yon* /yoN/ ‘four’, *roku* /roku/ ‘six’, *hachi* /hači/ ‘eight’, and *juu* /juH/ ‘ten’.

2. Methods

The data were collected through observation and interview Japanese native speakers. The data were identified in order to investigate which numerals have the potential to undergo some sound change. Those numerals are *ichi* /içi/ 'one', *san* /saN/ 'three', *yon* /yoN/ 'four', *roku* /roku/ 'six', *hachi* /haçi/ 'eight', and *juu* /juH/ 'ten'. They were then analyzed phonemically and some phonetically as well. The data analysis focused on the segmental elements and it was conducted synchronically.

3. Result and Discussion

The research data were gathered by ascribing numerals 1 to 10, respectively, to 50 quantifiers based on the variations of phonemic sound (vocals and consonants) that precede them so that each forms their distinct numeral quantifiers construction(s).

3.1 Phonemes that Undergo Sound change

Based on the acquired data, phonemes that undergo sound change can only be found in Japanese numeral quantifiers that consist of quantifiers preceded by voiceless phonemic sound (except for the quantifier *wa* /wa/) following certain numerals. Voiceless phonemic is a sound produced with the glottis in an open state resulting in no phonation of any kind (vocal chords do not vibrate) (Marsono, 2013:9).

Quantifiers preceded by voiceless sounds in the current study include *chaku* (着), *fuku* (服), *fun* (分), *fusa* (房), *hai* (杯), *hako* (箱), *haku* (泊), *hatsu* (発), *hiki* (匹), *ho* (歩), *hon* (本), *ka* (課), *ka* (日), *kai* (回), *kai* (階), *ken* (軒), *kiro* (キロ), *ko* (個), *kumi* (組), *kurasu* (クラス), *kushi* (串), *pakku* (パック), *peeji* (ページ), *pointo* (ポイント), *sai* (歳), *sara* (皿), *satsu* (冊), *senchi* (センチ), *soku* (足), *ton* (トン), *too* (頭), *tsu* (つ), *tsubu* (粒), and *tsui* (対).

In terms of methodology, these various quantifiers preceded by a voiceless phoneme were analyzed based on the sound of the preceding phonemes, namely /p/, /t/, /k/, /f/, /h/, /s/, /ç/, /c/. As for the numerals, they may be in the form of *kan* 'go numerals, e.g. *ichi* /içi/ 'one', *san* /saN/ 'three', *roku* /roku/ 'six', *hachi* /haçi/ 'eight', and *juu* /juH/ 'ten' as well as *wago* numerals, e.g. *mi* /mi/ 'three', *yo* /yo/ or *yon* /yoN/ 'four', *mu* /mu/ 'six', and *ya* /ya/ 'eight'.

3.2 The Process of Sound change

Sound change can be categorized into six classifications according to its formation process in the Japanese language numeral quantifiers construction. The first process is the assimilation of the consonant phoneme, the second process is the elision of the vowel phoneme, the third process is the elision of the vowel phoneme and assimilation of the consonant phoneme, the fourth process is the elision of the vowel phoneme and change in the consonant phoneme, the fifth process is phonemic coalescence, and the sixth process is change in the consonant phoneme.

1) Consonant Phoneme Assimilation Process

This is a process involving consonant phoneme assimilation occurring at the converging point of its two words of origin. In the present case, the assimilated phoneme is similar to the initial consonant phoneme of the quantifier which subsequently results in the double consonant phoneme /QC/ at the converging point of the two words of origin. Accordingly, the assimilation of the phoneme is affected by the sound of the subsequent phoneme, which means that this phonological process can also be specified as a regressive assimilation process.

2) Vowel Phoneme Elision Process

Elision refers to the omission or deletion of a part of a construction (Kridalaksana, 2008:176). As such, vowel

phoneme elision in Japanese numeral quantifiers may be defined as the deletion of vowel phoneme from its original word (input) in order to produce a numeral quantifiers construction (output).

Data analyses found that there are two types of vowel phoneme elision in Japanese numeral quantifiers. The first type of vowel phoneme elision refers to the elision of the high front vowel phoneme /i/ in the numeral *ichi* /içi/ 'one' and *hachi* /haçi/ 'eight' followed by the quantifier *chaku* /čaku/ which are combined to produce *itchaku* /iQčaku/ 'one suit' (of clothes) and *hatchaku* /haQčaku/ 'eight suits' (of clothes). The second type of vowel elision refers to the elision of the high back vowel phoneme /u/ in the numeral *roku* /roku/ 'six' followed by quantifier that begins with the phoneme /k/, of which one of them is *ko* /ko/ accordingly producing *rokko* /roQko/ 'six pieces'.

3) Vowel Phoneme Elision and Consonant Phoneme Assimilation Process

The vowel phoneme elision and consonant phoneme assimilation process involves two phonological processes that occur sequentially. This process can be found in the numeral *juu* /juH/ 'ten' that undergoes sound change to /juQ/ when followed by quantifiers that begins with the voiceless phonemes /t/, /s/, /č/, /f/, /c/, /p/, and /k/.

Among these quantifiers preceded by voiceless phonemes are *too* /toH/, *satsu* /sacu/, *chaku* /čaku/, *fusa* /fusa/, *tsubu* /cubu/, *peeji* /peHji/, and *kiro* /kiro/. One of the numeral quantifiers construction forms is *juu* /juH/ 'ten' + *too* /toH/ → *juttoo* /juQtoH/ 'ten large-sized animals'.

4) Vowel Phoneme Elision and Consonant Phoneme Change

The sound change process of vowel phoneme elision and consonant phoneme change also involves two phonological processes that occur successively. Data analysis results show that the process of

vowel phoneme elision and consonant phoneme change respectively take place at the last mora of the numeral word of origin, namely /çi/ from *ichi* /içi/ 'one', /ku/ from *roku* /roku/ 'six', and /çi/ from *hachi* /haçi/ 'eight'. As a consequence, these numerals, respectively, become /iQ/, /roQ/, and /haQ/ in the numeral quantifiers that each produces.

In the Japanese phonological system, the phoneme sound /Q/ is articulated as a sound that follows the sound of the subsequent phoneme, i.e. the sound of the quantifier's first consonant. Therefore, this sound change process may be categorized as a regressive assimilation process as it is influenced by the sound of the succeeding phoneme.

This sound change process occurs, among others, to the moras /çi/ from *ichi* /içi/ 'one' and *hachi* /haçi/ 'eight' which are respectively succeeded by quantifiers beginning with the consonant phonemes /t/, /k/, /s/, and /c/. These quantifiers, among them, are *too* /toH/, *ko* /ko/, *soku* /soku/, and *tsui* /cui/. One of the numeral quantifiers that can be produced is *ichi* /içi/ 'one' and *hachi* /haçi/ 'eight' that are respectively followed by the quantifier *soku* /soku/ producing *issoku* /iQsoku/ 'one pair' (of shoes, socks, etc.) and *hassoku* /haQsoku/ 'eight pairs' (of shoes, socks, etc.).

Additionally, this sound change process is also observed in the mora /ku/ from the numeral *roku* /roku/ 'six' which is followed by quantifiers beginning with the phonemes /t/ and /č/. One of the numeral quantifiers that can be produced is *rottoo* /roQtoH/ 'six large-sized animals'.

5) Phonemic Coalescence Process

The phonemic coalescence process occurs because the fusion between the numeral quantifiers produces a new phoneme found at the point where the sounds of the two words of origin converge. The phonemic coalescence process can be found in the numerals *ichi*

/içi/ ‘one’, *roku* /roku/ ‘six’, *hachi* /haçi/ ‘eight’, and *juu* /juH/ ‘ten’ when succeeded by quantifiers that begins with the phonemes /f/, /h/, and /w/.

Among the numeral quantifiers that can be produced are *ichi* /içi/ ‘one’, *roku* /roku/ ‘six’, *hachi* /haçi/ ‘eight’, and *juu* /juH/ ‘ten’ respectively followed by the quantifier *fun* /fuN/ producing *ippun* /iQpuN/ ‘one minute’, *roppun* /roQpuN/ ‘six minutes’, *happun* /haQpuN/ ‘eight minutes’, and *juppun* /juQpuN/ ‘ten minutes’.

6) Consonant Phoneme Change Process

The sound change process of consonant phoneme change is observed in the initial consonant phoneme of the quantifier in the numeral quantifiers construction produced. Accordingly, this sound change is produced as a result of the preceding phonemic sound, which classifies it as a progressive assimilation (influenced by a preceding sound). Based on the quantifier, this sound change process of consonant phoneme change can be specified into two categories.

First, the numerals *san* /saN/ ‘three’ and *yon* /yoN/ ‘four’ followed by quantifiers beginning with the phonemes /f/ and /h/. One of the numeral quantifiers that can be produced is the numeral *san* /saN/ ‘three’ followed by the quantifier *ho* /ho/ producing *sanpo* /saNpo/ ‘three steps’ and *yonpo* /yoNpo/ ‘four steps’.

Second, the numeral *san* /saN/ ‘three’ followed by specific quantifiers beginning with the phonemes /h/, /k/, /s/, and /w/. One of the numeral quantifiers that can be produced is the numeral *san* /saN/ ‘three’ followed by the quantifier *wa* /wa/ producing *sanba* /saNba/ ‘three winged animals’.

3.3 Causes of Sound change

The various sound change processes occurring in Japanese numeral quantifiers above may be caused by the following seven factors: 1) co-articulation of sound;

2) formation of nasal sound; 3) devoicing of the high vowel [i]; 4) Japanese phonotactics; 5) compression of articulation (to facilitate speech); 6) compliance with other formation models; and 7) *rendaku*.

1) Co-articulation of Sound

Co-articulation refers to the simultaneous articulation of two or more sounds (Kridalaksana, 2008:126-127). Such kind of articulation is a natural occurrence as a result of activities carried out by the speech apparatus in producing continuous linguistic sounds. Similarly, Vance (2008:45) argues that co-articulation is one of the results of rapid articulation of speech and it often leads to the assimilation of sound.

In the formation of Japanese numeral quantifiers, co-articulation is indicated in the sound of the phoneme /Q/ which is found at the point where the two words of origin converge. One of the phonological processes produced by co-articulation is the assimilation of the phoneme /t/. When articulating the initial sound, e.g. the numeral *mi* /mi/ ‘three’ combined with the quantifier *tsu* /cu/ subsequently assimilating the phoneme /t/ between the two sounds thereby producing the Japanese numeral quantifiers construction of *mittsu* /miQcu/ ‘three (objects)’.

2) Nasal Sound Formation

Nasal sound is produced by expelling airstream through the nose. To produce the sound, the soft palate (velum) along with the uvula is lowered so that air is restricted from exiting the mouth. Conversely, fricative sound is produced by narrowing the channel that air flows out of so that it exits the mouth generating audible friction. In order to articulate the two sounds successively, a nasal sound assimilation thus occurs (Tsujiyama, 1996:29).

This is the reason for the sound change in the convergence of the uvular nasal sound [N:] found in the ending

sound of the numeral *san* [sãN:] ‘three’, *yon* jõN:] ‘four’, and the interrogative *nan* [nãN:] when followed by the voiceless bilabial fricative [ɸ] and the voiceless glottal fricative sound [h]. In order to articulate both sounds successively, the uvular nasal sound assimilates itself with the articulation of the voiceless bilabial fricative sound [ɸ] and the voiceless glottal fricative sound [h], by articulating them into the bilabial nasal sound [m:]. Nevertheless, to be able to articulate the bilabial nasal sound [m:], the mouth must be closed so that the voiceless bilabial fricative sound [ɸ] and the voiceless glottal fricative sound [h] respectively undergo sound change into the voiceless bilabial stop sound [p] thereby producing the consonant sound cluster [N:p].

3) Devoicing of the High Vowel Sound [i]

In essence, high vowel devoicing does not imply losing the vowel sound, it is merely a lessening of the vowel sound so that the articulation becomes imperfect (it is much lessened up to the point that it is nearly unable to be heard) as a result of co-articulation with the voiceless consonant sound that precedes it (Okada, 1999:118; Vance, 2008:206).

According to results from the data analyses, the devoicing of high vowel sound resulting in sound change in the Japanese numeral quantifiers construction is only found in the numeral *ichi* [icɛj] ‘one’ followed by the quantifier *chaku* [cɛakw] producing *itchaku* [icɛ:akw] ‘one suit’ (of clothes).

4) Japanese Phonotactics

Japanese is a language that does not have consonant cluster phoneme, except for /NC/ and /QC/. The consonant cluster /NC/ refers to a consonant cluster consisting of a nasal phoneme and a consonant phoneme. Whereas the consonant cluster /QC/ refers to the double consonant cluster /QC/ except for the phonemic cluster comprising of the two voiceless consonants /f/ and /h/.

One of the forms of double consonants can be found in the numeral quantifiers construction produced by the numeral *ichi* ‘one’ and quantifiers that begin with voiceless phonemic sounds. As a result of the devoicing of the [i] sound in the numeral *ichi* ‘one’ elaborated in the above passage, a consonant cluster is produced consisting of the voiceless alveo-palatal fricative phonemic sound /ç/ and the voiceless consonant sound of the succeeding quantifiers. For similar voiceless consonant phonemes, they can immediately produce double consonant sounds as described in the previous passages, i.e. *itchaku* /iQčaku/ ‘one suit’.

5) Compressing Articulation (Facilitating Speech)

One of the means of facilitating articulation is by compression or contraction of speech. According to Verhaar (2004:85), contraction is the process of shortening or compressing words aimed at skimming on language use. This is in line with Poedjosoedarmo (1998:2; 2006:5) who argues that the rules of grammar are commonly intended to make clear, concise, and easy sentences.

Among Japanese numeral quantifiers, one of these contractions occur in the numeral *roku* /roku/ ‘six’ which undergo elision of the phonemic sound /u/ placed between the two voiceless velar stop consonant sound /k/. As a consequence, the geminate consonant phonemic sound /Q/ is produced at the pivot point between the numeral and the quantifier, e.g. *roku* /roku/ + *kai* /kai/ which is more frequently expressed as *rokkai* ‘six times’ than *rokukai*. Given the contraction of the consonant phonemic sound, speakers are able to save time (be more efficient) and energy in articulating linguistic sounds, hence making articulation easy and expediting the communication process.

6) Compliance with Other Formation Models

Based on the collected data, there are some numeral quantifiers produced by the same two words of origin yet they can be expressed in various manners. Some examples of such numeral quantifiers are *hatton* and *hachiton* ‘ten tons’, *hakko* and *hachiko* ‘ten pieces’ or ‘ten objects’.

Therefore, numeral forms that undergo internal phonemic change (formation of phoneme that differs from the original form) are new alternation forms produced on account of their compliance with other formation models. This is validated by the remaining use of the previously existing model hence resulting in several variations of form.

7) *Rendaku*

The phenomenon known as *rendaku* or sequential voicing refers to change in consonant sound from voiceless to voiced consonant sound (Irwin, 2005:127; 2009:180), which is only observed in the numeral *san* /saN/ ‘three’ followed by certain numeral quantifiers. This is in line with Vance (1982:340) who suggest that *rendaku* in its original form is the result of vowel sound elision sequentially followed by the assimilation of nasal sound. An example of a numeral experiencing *rendaku* is the numeral *san* /saN/ ‘three’ followed by the quantifier *hon* /hoN/ ‘long, cylindrical objects’ producing the numeral quantifiers construction *sanbon* /saNboN/ ‘three long, cylindrical objects’.

4. Conclusion

Sound change can only occur in *kan’go* numerals, i.e. *ichi* /içi/ ‘one’, *roku* /roku/ ‘six’, *hachi* /haçi/ ‘eight’, and *juu* /juH/ ‘ten’, and in *wago* numerals, i.e. *mi* /mi/ ‘three’, *yo* /yo/ ‘four’, *mu* /mu/ ‘six’, and *ya* /ya/ ‘eight’, followed by quantifiers that begin with voiceless consonant phonemes. Accordingly, all quantifiers beginning with voiced phonemic sounds do not experience sound change of any kind, except for the quantifier *wa* /wa/. The quantifier *wa* may undergo sound change, although it is not obligatory

(optional). The quantifier *wa* may experience sound change since the phonemic sound /w/ is similar to the phonemic sound /h/, which is found when writing the (Japanese postposition) particle using the hiragana letter *ha* but it is read as *wa*.

One of the indications used to identify whether a Japanese numeral quantifiers construction can undergo sound change is by examining the existence of the phonemes /QC/ and /NC/ situated at the point where the sounds of the two words of origin converge. This method can be employed as Japanese language is essentially a language with open syllables, implying that it always ends with a vowel sound, except for the uvular nasal sound /N/, which is considered a separate sound unit (a special mora).

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