Learning Third Language Improves Phonological Perception of Second Language

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1. Introduction

Nowadays, due to increased mobility and globalization, using more than two languages has become usual for many people (Jessner, 2006). Learning a third language (L3) is a complex process since learners of the third language already know two languages and there exists cross-linguistic influence (CLI) among three languages. The studies on CLI have been focused predominantly on the forward transfer (e.g. L1 to L2, L1 to L3) while the backward transfer (e.g. L2 to L1, L3 to L2) has not got much attention (Cheung, 2011). For understanding the nature of language knowledge and the essence of cross-linguistic influence, it is important to study the backward transfer.

Chuang(2002), Cheung (2011) and Griessler (2001) indicate the possibility of backward transfer from L3 to L2 in the domain of grammar and lexicon. While study on the backward transfer of phonological knowledge is needed for learners to enhance their language intelligibility (i.e. avoiding the communicative misunderstandings, conveying ideas correctly), such study is more challenging because phonological knowledge is likely to be more tacit than other linguistic knowledge (e.g. language users are often not consciously aware of how they produce and perceive specific sounds).

The perceptual assimilation model (PAM) is a theory that accounts for how native listeners perceive non-native speech sounds (Best, 1995). According to this model, the listeners assimilate non-native sounds to the most similar native phonemes, and also they discriminate the non-native contrasts regarding the extent of similarity with the native sound category. Although many studies have provided the evidence for PAM to support the validity in second language learning situations, it is still unclear that whether this model can still be applied to the backward transfer of non-native languages.

Therefore, it is important to known the fact about phonological backward transfer between non-native languages and also to better understand its mechanism. In this paper, we aim to show how the backward transfer of learning L3 influences the phonological perception of L2. This influence will be able to be observed if the second and third languages share some common characteristics whereas native language does not have. Therefore, we chose the vowel lengths of Chinese (L1), English (L2), and Japanese (L3) as an investigative target because the contrasts of short and long vowels exist in English and Japanese but not in Chinese.

In order to assess how learning L3 (Japanese) influences the L2 (English) vowel length perception, we conducted an identification task. In the identification task, participants were asked to identify the category of sounds. This task reflects the ability to perceive the sound according to internal phonological categories (Tsukada, 2011).

Generally, according to PAM, a category that is in L1 but not in L2 tends to be assimilated into another category in L1, which causes the low identification

correctness of L2. We suppose that there are internal categories about vowel length perception shared between L2 and L3, which are different from the categories in L1. In addition, we suppose that learning L3 will lead the backward transfer of the phonological knowledge for identifying these internal categories. Thus, our hypothesis is the following: Learning L3 (Japanese) has a positive effect on the L2 (English) vowel length perception. That our hypothesis were positively proved means that the category of vowel length in L2 is created rather than be assimilated into L1.

2. Experiment

2.1 Participants

In this experiment, there were two groups of participants, an experimental and a control groups. The experimental group was 20 native Chinese speakers who had learned English as L2 and Japanese as L3. They were international students at a Japanese graduate university. Their age ranged from 22 to 27 years old (mean = 24.9 years, SD = 1.61). The control group was 20 native Chinese speakers who had learned English only as L2. They were students at a Chinese university. Their age ranged from 19 to 24 years old (mean = 21.6 years, SD = 1.60).

2.2 Stimuli

The stimuli in the identification task consisted of 24 English words and 24 non-words with the C_1VC_2 structure (C=consonant; V=vowel), and 30 Japanese words and 30 non-words with the $C_1V_1C_2V_2$ structure. The V in the English stimuli was either short or long vowel (/ʌ/-/ɑ:/, /ɪ/-/i:/, /ɔ/-/ɔ:/, /u/-/u:/). Two words were paired to have the same C_1 and C_2 (such as /bɪd/-/bi:d/ and /dɔd/-/dɔ:d/). The V_1 in the Japanese stimuli was also either short or long vowel (/ʌ/-/ɑ:/, /e/-/e:/, /ɪ/-/i:/, /ɔ/-/ɔ:/, /u/-/u:/). Two words were paired to have the same C_1, V_2, and C_2 (such as /kado/-/kɑ:do/ and /gise/-/gi:se/). All stimuli are shown in Table 1.

Table 1. Stimuli used in the experiment

English word		English non-word	
Short	**Long**	**Short**	**Long**
but /bʌt/	bart /bɑ:t/	jat /dʒʌt/	jart /dʒɑ:t/
cut /kʌt/	cart /kɑ:t/	luc /lʌk/	larc /lɑ:k/
hut /hʌt/	heart /hɑ:t/	nap /nʌp/	narp /nɑ:p/
bid /bɪd/	bead /bi:d/	shik /ʃik/	sheak /ʃi:k/
fit /fɪt/	feet /fi:t/	dik /dɪk/	deek /di:k/
pick /pɪk/	peak /pi:k/	cid /sɪd/	ceed /si:d/
gock /gɔk/	gork /gɔ:k/	bom /bɔm/	bawm /bɔ:m/
dom /dɔm/	dorm /dɔ:m/	bok /bɔk/	bawk /bɔ:k/
pot /pɔt/	port /pɔ:t/	dod /dɔd/	dord /dɔ:d/
full /ful/	fool /fu:l/	guul /gul/	goul /gu:l/
bull /bul/	bool /bu:l/	jom /dʒum/	joom /dʒu:m/
pull /pul/	pool /pu:l/	phull /ful/	phool /fu:l/
Japanese word		**Japanese non-word**	
Short	**Long**	**Short**	**Long**
下部 kabu	カーブ kaabu	ヤヌ yanu	ヤーヌ yaanu
角 kado	カード kaado	ラヒ lahi	ラアヒ laahi
鳩 hato	ハート haato	ナヒ nahi	ナーヒ naahi
消す kesu	ケース keesu	テス tesu	テース teesu
世間 seken	政権 seeken	ケソ keso	ケーソ keeso
席 seki	正規 seeki	ネロ nero	ネエロ neero
北 kita	聞いた kiita	ギセ gise	ギイセ giise
ビル biru	ビール biiru	シセ shise	シーセ shiise
汁 shiru	シール shiiru	チラ chira	チイラ chiira
助詞 joshi	上司 jooshi	トニ toni	トーニ tooni
古都 koto	コートkooto	ソタ sota	ソータ soota
故事 koji	工事 kooji	コパ kopa	コーパ koopa
筋 suji	数字 suuji	ムヨ muyo	ムウヨ muuyo
主観 shukan	習慣 shuukan	ムセ muse	ムウセ muuse
手記 shuki	周期 shuuki	ユホ yuho	ユーホ yuuho

The stimuli were generated by using a Text-to-Speech application (GhostReader) and were evaluated by native English and Japanese speakers, respectively, to make sure a clear articulation.

The reason both the words and non-words were included is to analyze if the participants applied their phonological knowledge or used their memory of pronunciations learned.

2.3 Procedure

The participants' perception of vowel length contrasts was tested by means of a standard forced-choice identification task. We used an application developed by the experimenter (Fig. 1). The participants listened to stimuli under Audio-Technica FC707 headphones by clicking the play button ([ui3] in Fig. 1) with a self-pace. They were forced to select the length of vowel, V for English and V_1 for Japanese, between the options of long or short by clicking the buttons [ui4] under the conditions of stimuli spelling blindness (the spellings of stimuli

were not displayed in the questions in [ui1]), non-listening forbiddance (it was not allowed to go to the next stimulus without clicking the play button [ui3] at least one time), and stimuli replay limitation (the maximum replay time [ui2] was set up to three). These designs were considered useful for reducing the other possible effects on the performance of identification task.

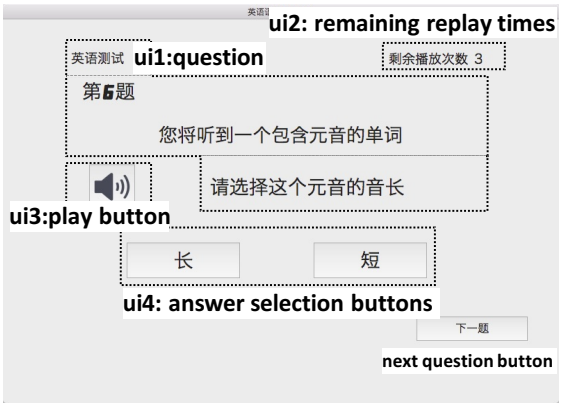

Figure 1. User interface of the identification task application

The task consisted of two blocks, English and Japanese, which order was randomized. The order of words and non-words in each block were also randomized. The practice trials (5 words) were provided at the beginning of each block to help the participants to understand how to use the application.

Before the identification task, we administrated the Language Background and Proficiency Questionnaire. The participants' background information, language learning experiences, and language proficiency were assessed using the questionnaire. The language proficiencies were evaluated by reference to the scores of College English Test Band 4 (CET4) for English and Japanese-Language Proficiency Test for Japanese Advanced Level (JLPT N1).

3 Results

Figure 3 shows the mean accuracy rates of the identification task for four types of words. The results were analyzed using a 2x4 mixed design ANOVA between group (control, experimental; between subjects) and word type (English word, English non-word, Japanese word, Japanese non-word; within subjects). The ANOVA showed significant main effect of group, $F(1, 38) = 43.20$, $p < .0001$, and of word type, $F(3, 38) = 14.81$, $p < .0001$. However, these main effects will not be discussed further, as the interaction between group and word type was significant, $F(1, 38) = 7.31$, $p = .0002$.

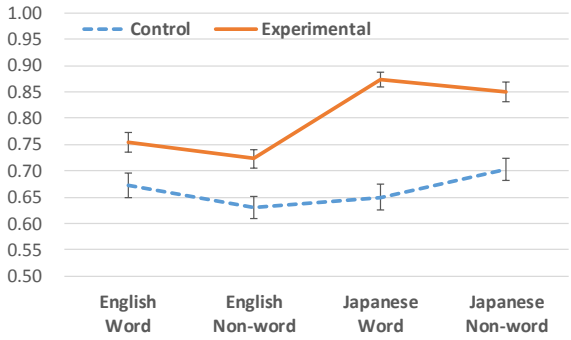

Figure 3. Mean accuracy rates (The error bars are standard errors)

The simple main effects of group within each word type were significant for the all word types; $F(1, 38) = 7.69$, $p = .0062$ for English word; $F(1, 38) = 10.24$, $p = .0017$ for English non-word; $F(1, 38) = 58.11$, $p < .001$ for Japanese word; $F(1, 38) = 25.06$, $p < .001$ for Japanese non-word. The simple main effects of word type in each group were also significant for the both groups; $F(3, 38) = 3.54$, $p = .0169$ for the control group; $F(3, 38) = 18.58$, $p < .001$ for the experimental group.

To test the effect of English proficiency, the mean score of CET4 for the two groups were compared using an independent t-test. The t-test was not significant, $t(28) = 0.714$, $p = 0.48$. To investigate the relationship between language proficiency and the accuracy rates, Pearson's correlation coefficients were computed. The results between CET4 and the accuracy rates of all word types in the both groups and in the all participants; and between JLPT N1 and all rates in the experimental group were not significant. The t-test for the learning years of English was

significant, $t(36) = 2.662$, $p = 0.011$. The correlation between the learning years of English and the accuracy rates of English word and non-word were not significant.

These results suggest that the Chinese natives who have learned the third language Japanese could improve the phonological perception of vowel length in the second language English, which means that our hypothesis was positively proved.

4. Discussion

The result that the L3 learners more accurately perceived the non-words of English and Japanese than the L2 learners, as well as the existing words suggests that the internal phonological knowledge of L2 and L3 were enhanced to create a new phonological category by learning L3. This result implies that PAM should be expanded to apply CLI between non-native languages.

Although all the experimental results support our hypothesis, there are some influential factors to be of concern.

The participants in the experimental group were studying aboard, which may have given them large opportunities of exposure to foreign languages. Such experience is considered as a trigger to improve the metalinguistic awareness that could be reflected on the abilities of various linguistic aspects (phonetic, syntactic, lexical and pragmatic). Therefore, it is important to consider the relationship between phonological backward transfer and the high order language capability such as metalinguistic awareness. To clarify the influence of such international environment on the backward transfer, an experiment involving L3 (Japanese) learners who have not studied aboard is needed. Also, an investigation of the metalinguistic awareness should be included in the experiment.

In the present experiment, we failed to control the age and the learning years of L2 (English). Although these factors did not correlate with the accuracy rate of English vowel length, it is better to control such factors to consider the fact and mechanism of the backward transfer.

5. Conclusions

We show that Chinese natives who had learned the third language Japanese could improve the phonological perception of second language English. It was suggested that the phonological category of the short/long vowel was created by learning the third language. This also means that the backward transfer of two non-native languages exists in phonological knowledge, at least from L3 Japanese short/long vowel to L2 English, as well as in the grammatical and lexical knowledge, and that the PAM should be expanded for CLI among more than three languages.

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