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英語塞音的語音轉移效應
——以台灣學童為例

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Phonetic Transfer on the Perception and Production of English Consonants by Taiwanese Children: A Preliminary Study

by

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關鍵字：拼音系統、轉移效應、知覺、產出

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Abstract

Taiwanese scholars and advocates dedicate themselves to the innovations of Romanization for written Taiwanese Southern Min (TSM). The considerations for TSM orthographic system imply that the actual phonetic realization of TSM symbols p, t, k is phonetically similar to English symbols b, d, g. This paper aims to examine whether the simultaneous instruction of two orthographic systems, TSM and English, would cause transfer effect. Two experiments are conducted. The results in perception part show that transfer effect occurs in the experimental group. The erroneous associations of /d/ with t and /g/ with k show significant differences. The results in production part show that the numbers of the subjects in the experimental group who associate symbols p, t, k with sounds /b/, /d/, /g/ are greater than those in the control group. As opposed to Experiment 1, the degree of transfer effect in Experiment 2 seems to be in a reverse direction: the degree of transfer effect in front stops is greater than that in back stops. It is due to the degree of familiarity and time of acquisition. The bilabial sounds are easier to produce, which causes a greater number of transfer effect.

1. Motivation[1]

According to Grade 1-9 Curriculum Guidelines of compulsory education[2], Taiwanese are expected to possess abilities in understanding and using English for communication across language boundaries, promoting world-view, prospering the country's industry and dealing with international affairs among different countries. In order to achieve these goals, the government of Taiwan made it compulsory for all fifth-grade elementary school students to learn English as a foreign language. In 2005, the policy was given further revision and as a result English instruction was forwarded from the fifth grade to the third grade of elementary school. English learning has since been implemented for 40 minutes a week.

Mandarin as the country's official language is taught in the national education system. In recent years, a language policy related to mother tongue is regulated into Grade 1-9 Curriculum Guidelines of compulsory education in order to break down ethnic barrier, develop students' confidence, understand local culture, respect cultural diversity, and promote the cooperative spirit among different races (Dong[3] ed. 2001). Based on Grade 1-9 Curriculum Guidelines, Taiwanese are expected to posses the ability to manipulate their mother tongue to communicate and express their thoughts in daily life. Beginning in the autumn semester in 2001, a 40-minute mother tongue course was imposed to the curriculum of elementary school. (Chiung 2007: 109). Different scripts for written Taiwanese Southern Min (TSM, hereafter) are selectively chosen by mother-tongue teachers, owing to lack of the written system of Han □ characters. According to Curriculum Guidelines, the orthographic system, the Romanized system for TSM, is instructed to third-graders.

As two orthographic systems, English and the mother tongue, are instructed simultaneously in the third grade, this paper aims to explore whether the instruction of mother-

1 I would like to thank Prof. Chun-yin Doris Chen for valuable comments and helpful discussion.

2 'Grade 1-9 Curriculum Guidelines' is translated as '□□□□□□□□□□□□□□□'.

3 The system used here for transliteration of names is *Han Yu Pin Yin* '□□□□'.

tongue orthographic system, TSM in this case, will influence the perception or the production of English items with stops in the initial position. In this study, we focus simply on the English stops, for the experiments were conducted in December and only stops of the mother tongue were instructed to the subjects. The knowledge of TSM phonology concerning the rules governing pronunciation or the domain of other segments irrelevant to the present experiments will not be introduced here.

2. Background

Let's first take a look at the phoneme inventory of TSM consonants shown in the

following table drawn from Liu & Tsay (2000: 110). ‘Vl’ is an abbreviation for the feature voiceless, ‘Vd’ for voiced, ‘unasp’ for unaspirated, and ‘asp’ for aspirated.

Table 1. Phoneme inventory of TSM consonants (IPA)

bilabial alveolar velar glottal

Vl unasp p t k □

asp p□ t□ k□

stop

Vd b g

nasal Vd m n □

fricative Vl s

affricate Vl unasp ts

asp ts□

liquid Vd l

As mother-tongue course is imposed to the curriculum in elementary school, different scripts of Romanization for written TSM are selectively used for the instruction, including International Phonetic Alphabet (IPA), *jiao hui luo ma shi* ‘□□□□□’, *Wang Yu-de* ‘□□□’(Wang, 1993), *Lin Ji-xiong* ‘□□□’(Lin, 1990), *ke gen shi* ‘□□□’, *pu min shi* ‘□□□’, and Taiwan Language Phonetic Alphabet (TLPA). In the consonantal phoneme inventory of TSM, both voicing and aspiration are contrastive features (Ding 1980, Dong 1996, Cheng 1997,

Zhou & Kang 1997, Lin 2001). Bilabial stops /p/, /p /, /b/, alveolar stops /t/, /t /, and velar stops /k/, /k /, /g/ contrast syllable-initially. Among scripts of Romanization, the aspirated voiceless stops are symbolized as the following three forms, which are currently used in different versions of textbooks for the instruction of TSM.

Table 2. The orthography of the TSM stops used in textbooks

bilabial alveolar velar

unasp p t k

Vl

stop asp p□/p’/ph t□/t’/th k□/k’/kh

Vd b g

3. Previous Studies of TSM Orthographic Systems Related to English

This paper aims to explore whether the simultaneous instruction of stops in both TSM and English orthographic systems will interfere with the perception and the production of English items with stops in the initial position. In order to meet the goal, the phonetic features of stops

in TSM and English orthographic systems need exploration first. In the following discussion, versatile innovations of TSM orthographic system that advocates claim as a brand-new system based on similar phonetic features of English stops will be elaborated.

In our handwriting, the actual letters we write vary and are quite different from the ideal shape, the phoneme. This is not represented in the phoneme system (Burns & Seidlhofer 2002). This very concept motivates the present study. The actual phonetic realization of TSM symbols p, t, k is phonetically more similar to English b, d, g. A piece of evidence that supports the view comes from Cheng (1993: 19-30, 1997: 11). TSM p is pronounced like English p occurring after sibilant /s/ as in 'speed', 'spy', and 'spoke' and sounds like English b. In the same vein, TSM t is pronounced like English t occurring after sibilant /s/ as in 'style', 'stay', and 'stood' and sounds like English d. TSM k is pronounced like English k occurring after sibilant /s/ as in 'skip', 'school', and 'sky' and sounds like English g. Cheng suggests that the beginners be

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aware of the similar phonetic realization of TSM symbols p, t, k and English b, d, g so as to avoid the confusion of two different orthographic systems.

Another piece of evidence comes from Ruan (1990) who strongly holds that TSM sounds /p/, /p□/ correspond to English sounds /b/, /p/, TSM /t/, /t□/ correspond to English /d/, /t/, and TSM /k/, /k□/ correspond to English /g/, /k/. He posited an orthographic system in which he straightforwardly regarded TSM /p/, /t/, /k/ as English symbols b, d, g and TSM /p□/, /t□/, /k□/ as English symbols p, t, k. In 1998, Ruan's system was adopted by Taipei City Department of Education as the official version of the orthographic system for TSM. This system caught many scholars' attention and then was affirmably advocated (Huang 1999: 43). Part of the TSM orthographic system Ruan (1990) posited is illustrated as follows.

Table 3. The orthographic system for TSM stops posited by Ruan (1990)
and its correspondences to KK phonemes

IPA for TSM	Ruan (1990)	KK phonemes
p	b	b
p□	p	p
b	v (weak)	b
t	d	d
t□	t	t
k	g	g
k□	k	k
g	q (weak)	g

With an eye to making TSM orthographic system more accessible in the computer era, Zhuang (1995, 2000) posited a PSDB orthographic system for TSM on the basis of 26 English alphabets. In order to encourage Taiwanese to effectively manipulate their mother tongue in the

written form, Zhuang's first priority is for the orthographic system to interact with computer technology. To achieve these effects, he proposes that TSM /p/, /p□/, /b/ are symbolized as English letters p, ph, b, TSM /t/, /t□/ as English letters d, t, and TSM /k/, /k□/, /g/ as English letters k, q, g respectively, as shown in the following table.

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Table 4. The orthographic system of TSM stops and its
English correspondences posited by Zhuang.

IPA for TSM Zhuang (1995)

p p

p□ ph

b b

t d

t□ t

k k

k□ q

g g

Again, Zhuang's system implies that at least TSM sounds /t/, /t□/ are perceptually regarded as English d, t respectively.

Another orthographic system was adopted in 2001 by the Bureau of Culture in Zhang-hua county. This system was then developed by Lin (2001). He claimed that it followed the common sense regarding phonetic features of English stops which correspond to those of TSM ones. His goal was to make the most use of English alphabets for TSM orthography and eliminate the inconsistencies between English and TSM spellings.

Table 5. The orthographic system of TSM stops posited by Lin.

IPA for TSM Lin (2001)

p b

p□ p

b b'

t d

t□ t

k g

k□ k

g g'

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Lin's system further implies that TSM p, t, k are perceptually viewed as English symbols b, d, g and that English sounds /b/, /d/, /g/ are near the domain of unaspirated voiceless stops, as

will be discussed later.

To summarize the discussion made so far, the advocates claim that they appeal to the phonetic features of English stops similar to TSM ones and try to provide a TSM orthographic system that eliminates the inconsistencies of spellings between English and TSM. However, they do not address explicitly the reason why TSM p, t, k may be wrongly regarded as English b, d, g. Ladefoged's analysis with respect to 'Voicing' and 'Aspiration' can resolve the problems that we confront so far. Ladefoged (2001: 119-120) writes:

English b, d, g often do not have voicing throughout the closure. When they are at the beginning of an utterance, the voicing may start just before the release of the stop, but on many occasions they may be completely voiceless. Between vowels, as in *abbey*, *adder*, *leggy*, they will be voiced throughout, but after a silence or a voiceless sound, as in *this boy*, *this day*, *this guy*, there will be little or no voicing during the stop…There is a small delay before the following vowel in which the air rushes out, forming what is known as aspiration. The English stops p, t, k are said to be aspirated.

As pointed out by Ladefoged (2001: 140), the versions of p, t, k occurring in other languages may not be exactly like the English sounds. TSM p, t, k are unaspirated voiceless stops while English b, d, g, on many occasions may be completely voiceless. Therefore, we see in many cases that the same letter is used for different sounds and different letters are used for the same sound (Goodluck 1991: 7). That is, TSM letters p, t, k and English letters b, d, g respectively are used for similar sounds.

Based on Ladefoged's discussion of English b, d, g and p, t, k, we can get the generalization that the actual phonetic realization of English b, d, g is phonetically similar to TSM symbols p, t, k, as shown in the following table.

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Table 6. Correspondences between TSM and English stops based on Ladefoged (2001) and Cheng (1993, 1997)

English (Ladefoged 2001) TSM

Aspirated

Voiceless

p, t, k (aspirated) p□, t□, k□

Unaspirated

Voiceless

p, t, k (after a sibilant), Cheng (1993, 1997)

b, d, g (after a silence, or a voiceless sound)

p, t, k

Voiced b, d, g (between vowels) b, g

To sum up, the advocates' considerations for TSM orthographic system show that the

actual phonetic realization of TSM symbols p, t, k is perceptually similar to English b, d, g and that TSM p, t, k have a potential for Taiwanese to be mistaken for English b, d, g, as pointed out by Cheng (1993, 1997).

4. Research Questions

The government of Taiwan implements language policy-the instruction of mother tongue and English included in the curriculum of the third grade in elementary school. Two experiments are conducted in English classes to explore whether the instruction of mothertongue symbols will influence the perception and the production of English symbols. The research questions are addressed as follows:

(1) Is the actual phonetic realization of TSM symbols p, t, k similar to English b, d, g perceptually? If so, the instruction of TSM letters p, t, k in orthographic system will impose effect on the experimental group in that hearing English items with sounds /b/, /d/, /g/ in the initial position will be visually associated with the letters p, t, k.

(2) Is the actual phonetic realization of TSM symbols p, t, k similar to English b, d, g perceptually? If so, the subjects in the experimental group will tend to produce English /b/, /d/, /g/ when seeing items with letters p, t, k in the initial position.

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5. Prediction

The class that is taught both TSM and English orthographic systems for 6 weeks serves as the experimental group while the class that is only taught English orthography is labeled as the control group. The TSM orthographic system may confuse young learners when they learn English language. The students learning mother-tongue and English orthographic systems at the same time may have difficulty distinguishing English voiced and voiceless stops in the initial position.

The purpose of Experiment 1 is to investigate the perception differences between the two groups by means of sound-symbol correspondence.

Figure 1. The sound-symbol correspondence in Experiment 1.

It is predicted that the experimental group tends to associate the audio sounds of English /b/, /d/, /g/ with symbols p, t, k perceptually because TSM alphabets exert interference with their visual perception of English alphabets.

The purpose of Experiment 2 is to investigate the production differences between these two groups by means of 6 items with p, t, k, b, d, g in the initial position. It is predicted that when seeing the items with p, t, k in the initial position, the experimental group tends to produce p, t, k as English /b/, /d/, /g/.

Sound

/ba/

‘pa’

‘ba’

□□□□□□□□□□□

□228□

6. Experiment 1

I. Subjects

Two classes of third-grade students participate in this experiment. They are students in Jian-guo Elementary School, in Kaohsiung city. Each class consists of about 22 students. Students in this school are scheduled to receive a 40-minute English and 40-minute TSM instruction every week. One class which comprises 20 students and has been taught the TSM orthography[4] for 6 weeks is the experimental group and the other class which comprises 22 students and listens to TSM materials of songs and stories without the instruction of TSM orthography is the control group. As for the materials in English instruction, 26 alphabets and greetings[5] are instructed to both classes.

II. Materials

Three items each for 6 English letters b, d, g, p, t, k in the initial position are selected. Basic monosyllabic English items are selected to minimize a bias for lexical familiarity. 6 irrelevant filters are inserted to the pool as distracters. A native speaker of English produces the 24 English items (18 target words and 6 distracters). The content of the recording is shown in Appendix 1. The recording is made in a quiet language laboratory. Each item is repeated twice and the interval between questions is 10 seconds. An answering sheet is prepared, as shown in Appendix 2.

[4] The TSM textbook used in *Jian-guo* elementary school is □□□□□□□□□ edited by the faculty of the school.

[5] The English textbook used in *Jian-guo* elementary school is “New Wow English” edited by Kang-xuan publisher.

III. Procedure

The participants are told to listen to the recording in English class and relate the word they hear to the two options on the answering sheet and then check the word they identify as the corresponding word. The numbers of errors are submitted to a one-way ANOVA.

IV. Results

The percentages of errors for the two groups are shown in the following. First, the total erroneous associations of English voiceless stops /p/, /t/, /k/ with letters b, d, g are analyzed based on a total of 378 responses (9 items x 42 subjects). Then the total erroneous associations of voiced /b/, /d/, /g/ with letters p, t, k are based on a total of 378 responses (9 items x 42 subjects). The results show that the total numbers of erroneous associations of /p/ with b, /t/

with d, and /k/ with g are not significantly different (F=0.028, P=0.869) while the total numbers of erroneous associations of /b/ with p, /d/ with t, /g/ with k are significantly different between these two groups (F=9.002, *P=0.008[6]).

We examine further in which association the experimental group makes more errors than the control group. The percentages of errors for each association are analyzed, as shown in the following tables. The analysis is based on a total of 126 responses (3 items x 42 subjects).

Table 7. Percentages of erroneous association of /p/ with b

Audio items	E	C[7]
/pa/	15	0
/p□n/	20	22.7
/p□t/	25	22.7
mean	**20**	**15.1**

F=0.361, P=0.58

[6] The mark * in this paper refers to significant differences.

[7] E stands for the experimental group; C stands for the control group.

Table 8. Percentages of erroneous association of /t/ with d

Audio items	E	C
/ta/	15	31.8
/t□n/	30	31.8
/t□t/	35	22.7
mean	**26.6**	**28.7**

F=0.097, P=0.771

Table 9. Percentages of erroneous association of /k/ with g

Audio items	E	C
/k□b/	5	13.6
/k□t/	15	31.8
/k□n/	45	36.3
mean	**21.6**	**27.2**

F=0.161, P=0.709

Table 10. Percentages of erroneous association of /b/ with p

Audio items	E	C
/ba/	45	27.2
/b□n/	35	45.4
/b□t/	25	31.8
mean	**35**	**38.4**

F=0.001, P=0.981

Table 11. Percentages of erroneous association of /d/ with t

Audio items E C

/da/ 35 22.7

/d□n/ 40 9

/d□t/ 35 18.1

mean 36.6 16.6

F=21.214, *P=0.01

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Table 12. Percentages of erroneous association of /g/ with k

Audio items E C

/g□b/ 5 36.3

/g□t/ 40 18.1

/g□n/ 45 22.7

mean 45 25.7

F=9.754, *P=0.035

The results from Tables 7~10 indicate that numbers of erroneous associations of English /p/ with b, /t/ with d, /k/ with g, /b/ with p are non-significantly different between the two groups. However, the number of erroneous associations of /d/ with t ($p<0.05$) and /g/ with k ($p<0.05$) are significantly different. The experimental group makes more errors than the control group in associations of English /d/ with t, and /g/ with k, as shown in Table 11 and Table 12.

7. Experiment 2

I. Subjects

The subjects of Experiment 2 are the two groups of the same students as in the Experiment 1.

II. Materials

The materials are the same 24 items as illustrated in Appendix 1 (18 target words and 6 distracters) for Experiment 1. What is the difference is that each item is written in a flashcard respectively.

III. Procedure

Experiment 2 is to test the production differences. Subjects are told to produce 24 words one by one in a quiet room in English class so as to let the students treat the 24 items as English words, not as TSM words. At the beginning of the experiment, it is found that 24 words are too

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stressful and tiring to the subjects. Some subjects can't even produce these items at all. Therefore, the materials are reduced to 6 items 'pa', 'ta', 'kab', 'ba', 'da', 'ga'.

IV. Results

As some subjects can't produce or refuse to pronounce the 6 items, the results of the experiments are descriptive. The analysis is based only on the production of 6 items in both groups. Moreover, the numbers of the subjects who produce the correct items and who produce /b/, /d/, /g/ when seeing p, t, k are counted. The subjects who produce errors are not our concern. The analysis is different from that in Experiment 1 for two reasons. First, the production errors contain variables that are not transparent. The errors may have a range of interpretations. Some of the subjects could not produce at all, some could only produce the names of the alphabets, and some may have wrong association with other irrelevant English words. The most ambiguous and indecisive part is the difference between one who is shy and chooses to be silent and another who is outgoing and produces a sound freely which turns out to be a wrong association with a target word. For example, one is trying to produce a sound /ba/ to stand for the word 'gab', and one refuses to produce any sound because s/he is shy and admits that s/he is not able to produce the sound. That is, the implication underlying the category in which a subject is classified as 'silent' or as 'wrong association' is unpredictable. Second, the subjects are in the beginning level in English learning. It is stressful and tiring for them, at least some of them, to produce the target words via blending two or more English letters. Therefore, only the correct production and whether the subjects associate English letters with sounds /b/, /d/, /g/ are our concerns in this experiment.

As the table 13 shows, 'pa' is pronounced as /ba/ in 25% of the subjects, 'ta' is pronounced as /da/ in 15% of the subjects, and 'kab' is pronounced as /ga/ in 5% of the subjects in the experimental group. In contrast, 'pa' is pronounced as /ba/ in 9.1% of the subjects, 'ta' is pronounced as /da/ in 4.5% of the subjects, and 'kab' is pronounced as /ga/ in 0% of the subjects in the control group.

Table 13. The numbers (percentage in brackets) of subjects for the correct production of English words with voiceless stops p, t, k in the initial position

	Experimental group			Control group		
The materials	pa	ta	kab	pa	ta	kab
Correct production	9(45)	10(50)	9(45)	12(54.5)	12(54.5)	11(50)
Produced as /ba/, /da/, /ga/	5(25)	3(15)	1(5)	2(9.1)	1(4.5)	0(0)
Produce the names of alphabets	2(10)	2(10)	2(10)	2(9.1)	3(13.6)	3(13.6)
Silent	2(10)	2(10)	3(15)	2(9.1)	2(9.1)	3(13.6)
Association to irrelevant items	2(10)	3(15)	5(25)	4(18.2)	4(18.2)	5(22.7)
The total number of the subjects	20	20	20	22	22	22

Table 14. The numbers (percentage in brackets) of subjects for the correct production of English words with voiced stops b, d, g in the initial position

	Experimental group			Control group		
The materials	ba	da	gab	ba	da	gab
Correct production	10(50)	9(45)	6(30)	12(54.5)	13(59.1)	7(31.8)

Produced as /pa/, /ta/, /ka/ 0 0 0 0 0 0

Produce the names of alphabets 2(10) 2(10) 2(10) 2(9.1) 3(13.6) 3(13.6)

Silent 2(10) 2(10) 3(15) 2(9.1) 2(9.1) 3(13.6)

Association to irrelevant items 6(30) 7(35) 6(30) 6(27.3) 4(18.2) 3(13.6)

Pronounce as /d□/ 3(15) 6(27.3)

The total number of the subjects 20 20 20 22 22 22

As demonstrated in Table 14, none of the subjects pronounces 'ba' as /pa/, 'da' as /ta/, and 'gab' as /ka/ in both experimental and control groups. The item 'gab' is pronounced as /d□□/ in 15% of the subjects in the experimental group and 27.3% of the subjects in the control group. This reflects an English-dominant production. If /d□□/ is viewed as a correct production, then the number of correct production for 'gab' will amount to 9 in the experimental group and 13 in the control group.

The results obtained from the students' production of 6 English words demonstrate that the

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subjects in the control group perform better than those in the experimental group. Moreover, the numbers of the subjects in the experimental group who associate English letters p, t, k with the sounds /b/, /d/, /g/ are greater than those in the control group: 25%, 15%, 5% versus 9.1%, 4.5%, 0%, as shown in Tables 13.

8. General Discussion

The result in Experiment 1 shows that the total numbers of erroneous associations of /b/ with p, /d/ with t, /g/ with k are significantly different between the two groups and is generally consistent with the first prediction: the experimental group tends to associate the audio sounds of English /d/, /g/ with symbols t, k perceptually because the instruction effect of TSM orthographic system exerts interference on their visual perception of English items. However, the percentages of respective erroneous association of /b/ with the letter p show no significant differences. Jakobson's (1968) idea can be used to account for the result. He proposes that "there are regular relationships between the distribution of speech sounds crosslinguistically and the order in which different sounds are acquired" (Goodluck, 1991: 19). Sounds that are frequently found in virtually all languages are the first to be acquired. Back stops are less frequent than front stops. "These frequency facts mirror acquisition facts: front stops are mastered before back stops" (Goodluck 1991: 20). Therefore, it is expected that the subjects are perceptually more familiar with /b/ sound and the transfer effect from TSM to English p may not occur. On the contrary, the alveolar stop /d/ and velar /g/ are acquired late and are more challenging perceptually than the front stop /b/. As a consequence, the transfer effect may not be easily noticed and manipulated by the subjects in the experimental group.

Let's look into the data in detail. The percentages of the mean scores of erroneous

associations errors of /b/ with p, /d/ with t, /g/ with k in the experimental group are 35%, 36.6%, 45% respectively, as shown in Tables 10, 11, 12. The degree of transfer effect in the experimental group is /b/ with p < /d/ with t < /g/ with k. The result shows that when the subjects encounter perceptually more definite, familiar and in the meanwhile less challenging

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information, the transfer effect may diminish.

As for the results of Experiment 2 in Table 13, the subjects in the experimental group made more errors than the control group. The percentages of the production errors for the associations of symbols p, t, k with the sounds /b/, /d/, /g/ are 25%, 15%, 5% in the experimental group and 9.1%, 4.5%, 0% in the control group. We see in the experimental group the degree of transfer effect is greater than that in the control group. None of the subjects in the control group produces /ga/ for English item ‘kab’. We can safely claim that owing to the interactions between two orthographic systems, TSM and English, the transfer effect does occur in the experimental group.

The results of Experiment 2 in the experimental group provide an interesting piece of evidence that seems to be contradictory to what we have obtained from Experiment 1. It seems that the degree of transfer effect in Experiment 2 is in a reverse direction, as opposed to that in Experiment 1. For the convenience of the discussion, the results of the degree of transfer effect (the percentages of erroneous associations) in both experiments are repeated as follows:

Experiment 1: /b/ with p < /d/ with t < /g/ with k

35% 36.6% 45%

Experiment 2: p with /b/ > t with /d/ > k with /g/

25% 15% 5%

Experiment 1 is the perceived association of English sounds /b/, /d/, /g/ with symbols p, t, k while Experiment 2 is the production relation between symbols p, t, k and sounds /b/, /d/, /g/. The fact that one perceptually acquires a certain sound does not necessarily equal to the fact that he is able to produce that sound. Production is a difficult task for the subjects. These beginners may have some of the perceived sensitivity of emergent learners but are still unable to apply their perceived sensitivity in the production task, especially in the production of items with back stops. As illustrated in the table 13, in the experimental group, if we merge the 3 classifications (‘Produce the names of alphabets’, ‘Silent’, ‘Association to irrelevant items’) into one category ‘not able to produce’, then 6 out of 20 subjects are not able to produce the

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item ‘pa’, 7 out of 20 subjects are not able to produce ‘ta’, and 10 out of 20 subjects are not able to produce the item ‘kab’. Looking into the data, we find that the subjects are not mature enough to produce back stops. To put it another way, if bilabial stops are mastered more easily

in the production part and the number of the subjects who is able to produce bilabial stops is larger than that of the subjects who is able to produce back stops, then it is certainly expected that the degree of transfer effect (error numbers) for front stops is larger than that for back stops. We can again safely claim that the transfer effect from TSM to English orthographic system does occur in the experimental group. The degree of transfer effect in Experiment 2, however, is not in a reverse direction, as compared to Experiment 1. It is simply because the bilabial sounds for beginners are easier to produce, which seemingly results in a greater number of transfer effect.

One may argue that the errors refer to one's ability instead of the transfer effect. The experimental group makes more errors than the control group simply because the control group happens to possess better ability in English and as a result, the control group performs better than the experimental group. The data in the production part indeed shows that the control group performs better than the experimental group. However, when we return to the perception part, Experiment 1, we see the argument that the errors refer to one's ability instead of the transfer effect is invalid. Let's return to the results in Experimental 1 again. The following table demonstrates the mean scores of the erroneous associations. The control group does not always perform better than the experimental group.

Table 15. The mean scores of the errors in Experiment 1

Erroneous associations	E	C
(1) /p/ to b	20	15.1
(2) /t/ to d	26.6	28.7
(3) /k/ to g	21.6	27.2
(4) /b/ to p	35	38.4
(5) /d/ to t	36.6	16.6
(6) /g/ to k	45	25.7

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9. Conclusion

The results of the erroneous associations of /b/ with p, /d/ with t, /g/ with k in Experiment 1 show that the simultaneous instruction of two orthographic systems in the third grade does cause the transfer effect. The degree of transfer effect is /b/ with p < /d/ with t < /g/ with k. However, only the erroneous associations of /d/ with t and /g/ with k show significant differences between two groups. In other words, the experimental group makes more erroneous associations of /d/ with t and /g/ with k. To sum, the degree of transfer effect may diminish, owing to the degree of familiarity and time of acquisition: back stops are acquired late than

front stops and are less familiar to learners.

Experiment 2 is the production relation between symbols p, t, k and sounds /b/, /d/, /g/. The transfer effect from TSM to English orthographic system does occur in the experimental group. The numbers of the subjects in the experimental group who associate symbols p, t, k with the sounds /b/, /d/, /g/ are greater than those in the control group: 25%, 15%, 5% versus 9.1%, 4.5%, 0%.

However, the degree of transfer effect seems to be in a reverse direction, as opposed to Experiment 1. It is because some subjects are unable to apply their perceived sensitivity in the production task, especially in the production of items with back stops. Moreover, the bilabial sounds for beginners are easier to produce, which in turn leads to a greater number of transfer effect.

Although the result of association of /b/ with p in Experiment 1 shows no significance, it well illustrates that when emergent learners encounter more definite, familiar, and less challenging information, transfer effect does not occur. The result also provides us with a promising vision: if learners receive a long-term instruction and the materials become more definite and familiar, the transfer effect may diminish with time.

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