Spelling-Sound Discrepancy and its Effect on Memory of New Words in L2

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Abstract

The purpose of this study was to determine whether type of grapheme–phoneme discrepancy (having a silent letter vs. having a wrong letter) had differential effects on memory of the phonological forms of new words and their processing rate in a L2 with a different script from the L1. To this purpose, 20 Persian speaking learners of English participated in a two phased experiment. First participants were divided into two groups and received 17 pseudowords including 5 with a silent letter, 6 with a wrong letter, and 6 with congruent graphemes and phonemes. They saw a picture showing the concept the item expressed and the written form underneath, and they listened to the phonological forms of the items. Then they received an auditory matching memory test in which they had to match the auditory name of the item with the correct picture. The pseudowords were presented through the Microsoft Power point software (2013) and the memory test was presented through the DMDX software (Forster & Forster, 2003). The paired samples t test was used to compare the performances on silent and wrong letter items. The results showed no effect of item type on accuracy and processing time. In other words, no difference was found for retrieving the correct meaning of the two different types of grapheme-phoneme discrepancies. The findings indicate that when learners learn a new language with a different script they may not pay a lot of attention to the written form, especially when the retrieval task requires the leaners to focus on the meaning and not the spelling of the words. Therefore, presenting or depriving the learners from the writing form does not make a big difference for learners in the early stages of learning new words.

Keywords: Orthography; Phonology; L2 word learning; Accuracy; Processing time; DMDX software

1.Introduction

The relationship between the orthographic and phonological forms of words varies across languages. Languages like Serbo-Croatian (Katz & Feldman, 1981) allow transparent relationship between the two. It means that grapheme–phoneme relationship is consistent and invariant. Therefore, the pronunciation of a novel word can be predicted by a relatively small set of rules. In English, however, the correspondence between spelling and sound is not transparent and there is not a perfect relationship between phonemes and graphemes representing those sounds. A phoneme can be realized by many different graphemes (e.g., /aI/ in mine, pie, and my), and a grapheme can also be realized by many different phonemes (e.g., the letter a in fate, pat, and wash). Besides, some letters are not pronounced (e.g., knight, psychology) while others might have wrong pronunciations (e.g., pizza, Xerox).

Although identification of written or printed words begins with the visual processing of letter symbols, there is substantial evidence that the phonological information behind the orthographic representations plays a crucial role in the process. In early studies, it was revealed that recoding of orthography to phonology occurs

during or even before readers' access to the lexical entries of visually presented words. (Bernet & Perfetti, 1995; Brysbaert, 2001; Drieghe & Brysbaert, 2002).

Orthographically presented words have been shown to activate phonological information, which is then used in identifying words and hence their meanings. In semantic categorization tasks where participants are asked to decide whether a particular word is a member of a semantic category (e.g., FLOWER), participants are more likely to commit false positive errors for homophone controls (e.g., ROWS) and pseudo-homophones (e.g., ROWZ) than for a spelling-matched control (e.g., ROBS, in Van Orden, Pennington, & Stone, 1990). This indicates that words that share phonological representations are confusable because identification of visually presented words depends on the phonological information readers access in orthographic words.

In Ota, Hartsuiker and Haywood (2009), three groups of participants including native speakers of English, Japanese, and Arabic were asked to do a semantic-relatedness judgment task on some English words. Native speakers of English were less accurate and slower in rejecting pairs that contained a word with a homophone related to the other member of the pair (e.g., MOON-SON) in comparison to spelling controls (e.g., MOON-SIN). This was also the case with the nonnative speakers of English, demonstrating that the phonology of L2 words is being processed in L2 visual word recognition too. The nonnative participants also exhibited homophone-like effects in judging pairs that contained a word differed phonologically from a related word by a segmental contrast missing in their L1. The results of this study show that not only phonological mediation can take place in bilingual visual word recognition but also that the phonology of L1, in addition to that of the L2, is active in the silent reading of L2 words.

It is worth and vital that orthographic knowledge modifies the nature of the mentally stored phonological information, and that the influence of orthography on spoken word processing arises indirectly from this phonological representation (e.g., Peereman et al., 2009; Perre et al., 2009). A description of how orthography might be included in the phonological system is given by Taft (2006b), who proposes an abstract phonological level of representation directly reflecting the pronunciation of the spelling of the word (i.e., an orthographically influenced phonological representation or "OIP"). For example, the word corn is represented at the OIP level with a post-vocalic r (i.e., /korn/) even for non-rhotic speakers of English who do not pronounce the postvocalic r [kɔ:n]. The evidence comes from the fact that non-rhotic English speakers find it hard to recognize the homophony of a pseudohomophone that conflicts with its base word in terms of a post-vocalic r (Taft, 2006). For example, many non-rhotic speakers do not realize cawn is homophonic with corn unless they read it aloud. This implies that the representation of or and aw do not match in the underlying phonological system, and only coincide at the surface phonetic level.

As mentioned before, most research studies show the mediation of phonological knowledge in orthographic knowledge in word recognition and meaning retrieval. However, when it comes to learning new words in L2, the nature of interaction between the two systems might be questioned. Do L2 learners pay attention to the orthographic representation and use it as a cue for learning new words and their meaning retrieval later, especially when there is no one to one relationship between the phonological and orthographic representation? The issue is worth studying as research shows the mediation of phonological knowledge in word recognition and meaning retrieval in many cases. In fact, the question would be if orthography can be an important factor in learning new words in L2 and if the discrepancy between the phonological and orthographic knowledge can make a difference. In a nutshell, this study will provide grounds for investigating whether it is better to teach the spelling of new words along with the phonological representation when there is a discrepancy between the two. The following research questions are addressed in this study.

1.Do differences in grapheme-phoneme representation of pseudowords, having a silent letter, help learners to recall the meaning of pseudowords better and faster?

2.Do differences in grapheme-phoneme representation of pseudowords, having a wrong letter, help learners to recall the meaning of pseudowords better and faster?

2. Methodology

2.1 Participants

Twenty pre-IELTS male and female students who were studying English at Danesh Pajouhan institute in Esfahan, Iran, were selected to take part in the study. Then they were divided into two groups respectively called Incongruent Silent-letter and Incongruent Wrong-letter. They were native speakers of Persian and their knowledge of English was limited to the courses they studied in language institutes and universities. Furthermore, they never had exposure to English in natural settings.

2.2 Materials

This experiment contained two phases: 1- studying phase and 2- testing phase.

2.2.1 Studying Phase

A list of 17 pseudowords with a bysillabic structure CVCV(C) containing phonemes that exist in English was selected. They were produced by Wuggy Generator Software. Each pseudoword was assigned a specific picture in order to make it meaningful. They were presented through the Power Point software (2013) such that each picture was displaying simultaneously with its written form and its pronunciation. Three kinds of items were used in the study phase (Table 1):

(A)6 congruent items with regular phoneme-grapheme correspondency (e.g. the spoken form [roudət], the written form **<**Rodat**>**, picture of panda), (B) 6 incongruent items with a silent-letter in written forms (e.g., the spoken word [b^ntIl], the written form **<**Butil**>**, picture of apple), and (C)6 incongruent items carrying a wrong phoneme or letter in their written form (e.g. the spoken word [fɑʃəm], the written form <Fɑzam>, picture of cabbage). The pseudowords were presented in three different orders to counterbalance the order of presentation: WSC (Wrong letter, Silent letter, and Congruent letters), SWC and CSW.

Table 1 Written Label Types for the Incongruent/congruent items

Written Label Type	*Description*	*Examples*
Congruent (n=6)	Congruent with English spelling conventions	<ramper>, /ræmpər/;
Incongruent-Silent-Letter (n=5)	The written words contain a "silent" letter; the spelled sequence<nt>mapped to /t/ ,<lt> mapped to /t/; <db> mapped to /b/, and <sk> mapped to /k/	<butil>,/b^ntIl/; <cobeet>,/c^dbi:t/; <pikil>, /pIskIl/
Incongruent-Wrong-Letter (n=6)	The written forms contain a mismatch between a letter and phoneme; the letter <ʃ> mapped to/z /,<v> mapped to/l/, <tʃ> mapped to /d/, and <ʃ> mapped to/f/, <p> mapped to /n/, <t> mapped to /z/	<fazam>, /fa:ʃəm/; <pooler>, /pu:vər/; <bafel>, /bæʃəl/

2.2.2 Testing Phase

Two different tests were used 1- criterion test and 2- meaning recall test which are briefly discussed below:

2.2.2.1. Criterion test

In order to see whether the participants learned 90% of the words they received during the study phase, they got the criterion test. If they were not able to achieve 90% accuracy, they needed to go through the study phase again. Each Picture in this test was presented two times: once with a matched name and once with a different name.

2.2.2.2. Meaning recall test

Meaning recall test was given to the participants to see if they were able to recall the meaning of words taught to them in the study phase. The test was an auditory word-picture matching test that was like the criterion test previously mentioned in which participants judged a spoken word on the basis of its correct label in each picture. Seventeen pairs were mismatched, six of which were congruent spelling items where congruent words were paired with wrong pictures. New auditory stimuli were prepared for the remaining 12 mismatched items: there were auditory words representing the incongruent spelled forms presented during training in study phase (e.g., auditory [b^ntil] and [fazəm], see Table 2). They were paired with their corresponding pictures (e.g., auditory [b^ntil] with a picture of an apple) to form six mismatched incongruent-silent-letter items and six mismatched incongruent-extra-letter items.

Table 2 *Example of Mismatched and Mismatched Listening Test Items*

Stimulus condition	Auditory word at test	Picture	Trained auditory word written form(s)
MATCHED between picture and auditory label			
Congruent	[roudət]	Panda	[roudət] Rodat
Incongruent-Silent-letter	[b^ntil]	Apple	[b^ntil] buntil/butil
Incongruent-wrong-letter	[fɑʃəm]	Cabbage	[fɑʃəm] fasham/fazam
MISMATCHED between picture and auditory label			
Congruent	[roudət]	Panda	[roudət] Rodat
Incongruent-Silent-letter	[b^til]	Apple	[b^ntil] buntil/butil
Incongruent-wrong-letter	[fɑzəm]	Cabbage	[fɑʃəm] fasham/fazam

Incongruent-silent-letter pairs were predicted to be as difficult as the incongruent-wrong-letter pairs. As mentioned before, in both types of incongruent mismatched items, pictures were paired with labels that sounded similar to the written labels but different from the labels heard in the study phase.

2.3. Procedure

The participants received the study phase, criterion test and meaning recall test in the same order in a quiet room. The instructions appeared on the screen and participants heard the presented words through their headphones while the pictures indicating their meanings were being displayed on the computer screen. The Word Power point (2013) and the DMDX software were used for the presentation of materials in the study and testing phases respectively. In the testing phases, the participants were asked to determine if each picture matched the pseudoword they heard in the study phase by pressing the *Right Shift* button (if they totally matched) and the *Left Shift* botton (if they did not match) on the computer keyboard.

3. Results

The following issues were considered in data analysis. RTs were measured from target offset in millisecond. Missing data ranged from 0 to 9 (20.15% of data for each item). One of the participants made more than 20% errors. Therefore she was replaced with another one. Regarding the items, learners made about 34.8% errors on item 128 and 47.8% errors on item 134. Therefore, these two items were discarded from further analysis. The discarded items were *pooler* and *moler* and it seems that the similarity of phonemes in their place of articulation and number of phonemes might have confused the participants when processing these items.

First, the results of data analysis regarding accuracy of responses and then those related to reaction times are presented. All analyses (accuracy and reaction times) were based on correct responses while incorrect responses were ignored. The paired samples *t* test was used to compare the performance of the participants on each item type. The following table (3) shows the descriptive statistics related to the items.

Table 3: Descriptive Statistics of Wrong-Letter and Silent-Letter

Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
Pair 1mismatcched wrong letter	.7950	20	.18418	.04118
mismatched silent letter	.8200	20	.19358	.04329

As it is shown in table (3) Comparing the mean scores shows that participants were more accurate on silent letters. However, this difference is not statistically significant as the following table (4) shows.

Table 4: Paired Sample t Test Between Wrong-Letter and Silent-Letter Groups

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	mismatcched wrong letter - mismatched silent letter	-.025	.24198	.05411	-.13825	.08825	-.46	19	.649

From the table (4), it can be concluded that the mean difference is not significant, t (19) =.46, p >.649. In the next table (5) RTs were compared.

Table 5: Statistics Difference in RTs Between Wrong-Letter and Silent-Letter

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	mismatched wrong letter	2552.6749	20	205.70483	45.99700
	mismatched silent letter	2542.2061	20	257.83000	57.65254

The table (5) shows that the mean scores are not very much different from each other. To see the means were statistically significant the paired sample t test was run as seen in table (6) below.

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	mismatched wrong letter - mismatched silent letter	10.46879	186.34233	41.66741	-76.74210	97.67969	.251	19	.804

The *t* test run on the mean scores shows no significant difference between the means, indicating that both item types were processed at the same speed, $t(19) = .251$, $p>.05$.

4. Discussion

The aim of this study was to determine whether different types of grapheme–phoneme correspondence mismatches (e.g., adding a "silent" letter, and having a wrong letter) influenced learners' memory of the phonological forms of words and their processing rates. To this end, 20 Persian speaking learners of English were given 17 pseudowords to study and learn. For each item, the spoken form, the written form, and a picture showing its meaning were presented simultaneously. The items were of three types: one type based on regular English phoneme-grapheme correspondency, another type having a silent letter, and the third type having a wrong letter. The participants were later tested on their memory of the meaning of pseudowords in an auditory picture-matched test. Paired samples *t* tests were used to analyze the data. The results showed no significant difference between the performances on each type, neither for accuracy nor for processing time.

The results of the study are in contrast to Hayes-Harbs et al (2010), who found that orthographic representations can be part of the memory of the phonological forms of the words when the discrepancy involves a mismatch in a letter's phonemic correspondent. This effect was observed only for wrong letter items and not silent letters. They attributed the lack of detrimental effect of silent letters to greater familiarity of native speakers with them. More research studies are required to shed light on this matter, as having a wrong letter is not unfamiliar to native speakers of English either. Hayes-Habs et al.'s study was conducted with native speakers of English, so the difference can be attributed to the participants. It seems that for Persian speakers learners of English both types are the same and neither can be different in any way from the other.

Attempting to show if the presentation of written form could affect the memory of the new words in L2 for speakers of Persian, a language with a different script from English, Masoumzadeh (2014) compared items with a silent letter and items with a wrong letter with congruent items separately. He found that performance on

memory test for the phonological labels of pseudowords was slowed down but no change was observed in terms of accuracy. He used the findings to conclude that second language learners whose first language has a different script do not use the written form accompanying the auditory label when learning new words.

On the basis of the findings, it seems that L2 learners do not pay a lot of attention to the spelling form of new words. One reason might be the limited capacity of working memory and the issue that simultaneous attention to both spoken and written forms is more demanding for L2 learners. Another reason can be lesser importance they give to spelling and priority they give to auditory labels as a clue to the meaning of new words.

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