

ORTHOGRAPHIC KNOWLEDGE AND WORD RECOGNITION SPEED I

Hiroshima University, Graduate School Yosuke Yanase

1. INTRODUCTION

This study attempted to see whether a test of orthographic knowledge would work as an aptitude test for reading in English. A word-likeness judgment test was conducted to assess orthographic knowledge. It was found that orthographic knowledge gradually increases with reading experience. Five high school students (Grade 1) with high scores in the test and five students with low scores were selected as subjects to see whether a relationship exists between orthographic knowledge and word recognition, which is the most fundamental component of reading. It was found that there was no relationship between them. The particular test of orthographic knowledge was not concluded to be appropriate as an aptitude test. Yet further study is necessary to conclude that there is no relationship between orthographic knowledge and reading ability.

2. ORTHOGRAPHIC KNOWLEDGE

2.1. Theoretical Background

The orthographic redundancy of English is enormous. Smith (1982 : 126) states that if all 26 letters of the alphabet could occur without restriction in each position of a five-letter word, there could be nearly 12 million different five-letter words, compared with perhaps 10,000 that actually exist. Given the nature of orthographic constraint in English, it is reasonable to assume that orthographic knowledge contributes to reading in the language. Orthographic knowledge develops through reading (Taylor and Taylor, 1983 : 154). Yet it is unknown how it develops. Does it develop homogeneously, that is, with little individual difference? Or are there relatively wide individual differences? If the latter is the case, it is possible that those with good knowledge of orthographic constraint are more sensitive to the language. It can further be assumed that this sensitivity or the orthographic knowledge contributes to fluent reading in English.

In fact, Zivian and Samuels (1986) found, by conducting a word-likeness judgment task, that knowledge of orthographic structure is positively related to reading ability. Subjects in the study of Zivian and Samuels were normal children and reading-disabled children between the ages of 8 and 11 years. All subjects were native speakers of English. Also many researchers claim that orthographic knowledge helps word recognition (Juel 1983, Massaro and Taylor 1980). The present study assessed orthographic knowledge of some learners of English in Japan. The points of interest were 1) whether orthographic knowledge developed with reading experience and 2) whether individual difference existed.

2.2. Method

Subjects : The total 224 subjects consisted of three subgroups ; 38 Grade 1 students in the

affiliated junior school of Hiroshima university ; 123 students in the affiliated senior high school (42 in Grade 1, 41 in Grade 2, and 40 in Grade 3) ; 63 students in the faculty of Education (English Education major) in Hiroshima University (30 freshmen and 33 sophomores).

Material : The target nonwords comprised of 26 orthographically correct nonwords and 26 orthographically incorrect nonwords (See Appendix 1). These nonwords were taken from the study of Rubenstein *et al.* (1971).

Procedure : The subjects were given a piece of paper on which the 52 target words were written and asked to judge whether a target word looked like an English word or not. They had been told beforehand that the target words were all nonwords. A time limitation was not set.

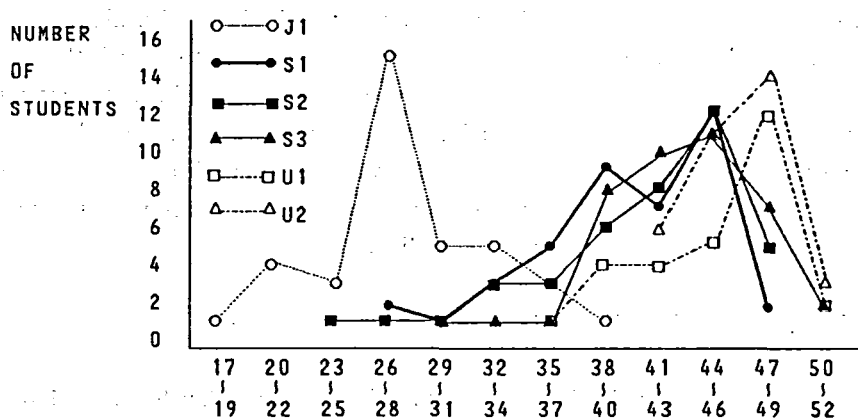


Fig. 1 SCORES OF THE WORD-LIKENESS JUDGMENT

2.3. Results

Distribution of the scores is shown in Figure 1. The scores of the first graders of the junior high school (J1) with about 3 month experience of formal learning of English shows the normal curve with its center at the random point. As for the senior high school students, the modes shifted to the right compared to the mode of the junior high school students and the left sides of the modes gradually decrease. The distributions for the university students show that there are ceiling effects. In fact, no sophomores obtained scores under 40. The distribution for the sophomores show a sharp contrast with that for the junior high students ; the former indicates high mastery of orthographic knowledge and the latter indicates practically no knowledge of orthography (random guess).

Aside from the junior high school students, an analysis of variance shows that the knowledge of orthography increased with grade (reading experience) in English ($F(2,120)=4.2$, $p < .05$). A chi-square test indicates that those who made more than 34 correct judgments are concluded to have orthographic knowledge with 5% level of significance ($\chi^2=4.92$) (For the employment of a chi-square test, see Iwai and Suzuki 1985 : 122-124). Most of the senior high school students and all of the university students reject the null hypothesis ; they are considered to have orthographic knowledge.

2.4. Discussion

Although the subjects had been given no formal instruction on phonotactics, they gradually

gained orthographic knowledge. Acquisition of orthographic knowledge occurs through exposure to the written English language. Yet, when the exposure is little (three months for the junior high school students), learners have yet to acquire orthographic knowledge and therefore make random guesses in a word-likeness judgment test. Relatively wider individual differences of orthographic knowledge of senior high school students shrink with reading experience. Considering the distribution for the junior high school students and that for the university students, it is argued that there is little inherent difference in acquisition of orthographic knowledge; learners equally do not have orthographic knowledge at first and again equally acquire it at last. Yet, individual differences in the senior high school students presents a possibility that those who obtained scores under 34 are somehow linguistically insensitive. The next concern in the present study is to compare these subjects with those who obtained high scores by means of a word recognition task, which is the most fundamental reading task. If difference in processing time is found in the word recognition task, it is suggested that difference in orthographic knowledge indicates aptitude for foreign language learning.

3. WORD RECOGNITION

3.1. Theoretical Background

Word recognition, the most fundamental process of reading, is not a trivial process in understanding reading. Many researchers agree that difference in processing time in word recognition indicates difference in reading ability (Juel 1983 : 306, Perfetti 1985 : 90). Then if difference in orthographic knowledge predict difference in speed of word recognition, it follows that the former predicts difference in reading ability. A hypothesis is established that subjects with high orthographic knowledge will recognize words faster than subjects with less orthographic knowledge.

3.2. Method

Subjects : 10 subjects were chosen from Grade 1 of the senior high school. Five were students who obtained scores under 34 (mean=30.4, SD=3.0) and the other five students were those with the highest scores (mean=46.2, SD=1.2). Their difference in orthographic knowledge is statistically supported ($t=9.8, p < .01$).

Material : 20 words for word recognition were taken from the 490 basic words selected by the Ministry of Education. These words were learned by the subjects in junior high schools and considered to be familiar to the subjects. The words consisted of 10 short words (3-4 letters, the average number of syllables is 1.1) and 10 long words (8-10 letters, the average number of syllables is 2.6) (See Appendix 2).

Procedure : The subject sat in front of a computer screen. The target words appeared on the screen successively. The subjects were asked to press a certain key on a computer keyboard immediately when they thought they recognized the word. They were given explanations and five trials before the experimental task began. The experimenter assured that each subject had understood the task clearly. After the trial the subject was presented with a word and pressed the key. This procedure made the word disappear and the next word appear immediately. Actually, the subject was presented with 30 words, the first

ten of which were for practice (the subject did not know this). These 10 words were not measured for the recognition speed. The reaction times to the rest of the 20 words were measured with a BASIC computer program. The reaction time was measured of the frequencies of circulating the program loop. Exact transformation of the frequencies into millisecond was impossible. The essential part of the program is listed in appendix 3. The computer used was NEC's PC-9801UV2'.

Unfortunately, there is a problem in this method : there was no guarantee of correct word recognition. Unlike a naming or a lexical decision task², there was no way of checking whether a subject really recognized the target word. Thus, it was possible that the subjects just pressed the button without correctly recognizing the word. This problem will be dealt with later. The results were analyzed in a 2x2 factorial design with repeated measurements on the length factor. The null hypothesis was that orthographic knowledge dose not facilitate the word recognition speed.

3.3. Results and Discussion

It was found that only the effect of length was significant ($F(1, 8)=20.02, p < .01$). Both the effect of orthographic knowledge ($F(1, 8)=.47$) and the interactional effect ($F(1, 1)=.10$) were nonsignificant. These results suggest that orthographic knowledge did not facilitate word recognition speed : the null hypothesis was not rejected.

The above findings are inconsistent with Zivian and Samuel's study. There are several possible explanations why the present experiment did not show the effect of orthography. The first possible explanation is that some of the subjects may have employed a particular strategy. As mentioned earlier, the present experimental task had no way of checking whether a subject really completed the word recognition task. It is quite possible that some of the subjects merely pressed the key on seeing a visual image on the computer screen. If this was the case, it was probable that the data are distorted.

The second explanation is the scarcity of subjects. Only ten subjects participated in the word recognition task. This was deliberately done or rather had to be done because only five students among the first graders of the senior high school students had scores under 34, which was the critical score. (Due to the classroom managment, it was impossible to ask the second or the third graders.) So there was no alternative to having only five subjects in the low score group. This was a risky decision, for too few subjects often fail to reflect the nature of the population.

The third explanation is concerned with the reliability of the test of orthographic knowledge. What the subjects had to do was to just mark a circle or a cross next to a target word according to the word-likeness. This simplicity of the task might have somewhat discouraged seriousness towards the task for some subjects. It is possible that those who obtained scores nuder 34 did, in fact, have orthographic knowledge, and thus fail to show difference in terms of word recognition speed with the other five subjects with high scores.

The fourth possible explanation is rather radical : there may be no relationship between orthographic knowledge and word recognition. Stanovich (1980) is skeptical about the relationship and claims that conscious orthographic knowledge in a paper and pencil test

is not necessarily related to the ability to use knowledge orthographic structure to actually *speed* word recognition. This problem of knowledge and its use is quite debatable. To solve the inconsistency of the above assertion and Zivian and Samuel's finding, a further study needs to examine the tasks employed in the studies to clarify the operational definitions of 'knowledge' and 'use'.

The fifth explanation is suggested by Stanovich (1986). In his study, he clarified developmental changes in the acquisition of reading skills. He argues that some indices, like phonological awareness, will explain the acquisition at an early stage and yet cease to do so at a later stage. It is possible that the subjects no longer needed orthographic knowledge to recognize such familiar words as the ones used in the task.

This leads to the sixth explanation : that choice of target words was not appropriate. The target words were learned by the subjects mostly three years before the experiment. Since the words have high frequencies, they were thought to be quite familiar to the subjects. Thus, the words are not likely to produce difference in word recognition speed as less frequent words are. If less frequent words had been chosen as target words, the difference in word recognition speed might have been greater. Also, if orthographically regular words and irregular words had been compared, the results might have been in favor of the expected hypothesis. In these two senses, the present experiment chose target words which were not as sensitive to the assumed effect of knowledge of orthography as they should have been.

The last explanation is somewhat related to the previous one. Inappropriate difficulty of the word recognition task might have reduced the effect of orthographical knowledge. The task might have been too easy : the visual condition of the computer screen presented no problem ; the target words were familiar enough ; neither meaning retrieval nor naming were required. If the visual condition had been deliberately deteriorated, or if the target words had been represented in mixed case, or if meaning retrieval or word naming had been required, then the effect of orthographic knowledge might have emerged. Obviously, it may well be the case that some or all of these explanations are valid. Given the present experimental design, it is impossible to identify the cause of the inconsistent findings. Future research needs to explore at least theoretical aspects of the explanations.

4 . SUMMARY

Learners of English as a foreign language acquire orthographic knowledge easily, as is evidenced by the fact that the university students acquired it with no exception. Orthographic knowledge gradually increases. However it is not yet known how exactly the acquisition takes place in the first few years. A longitudinal study would reveal how many months of reading experience in a formal setting are necessary for the acquisition of orthographic knowledge.

Unlike Zivian and Samuel's finding, the present study did not find the effect of orthographic knowledge in reading ability. Several explanations were suggested for a future study. Given this ambiguity of the experimental task, it should not be concluded that a test of orthographic knowledge cannot be an aptitude test for reading in a foreign language.

Note

- 1 I would like to thank the department of Mathematics in the affiliated school of Hiroshima University for the permission of the use of the facility.
- 2 The present study did not employ a naming task or a lexical task or an accuracy task because 1) the first task needs a special microphone which coordinates with a computer 2) the second one is impossible for non-native speakers 3) the third task is difficult to carry out on a computer screen.

Appendix 1

Orthographically correct nonwords : tors, flad, bleg, nump, stron, lurt, flact, herv, loisp, melp, drilt, jund, nosk, prind, delm, marp, stude, staim, fronk, clefe, flet, prot, greel, firse, fure, beral.

Orthographically incorrect nonwords : ceavb, rduk, scolor, tritv, cresf, sagm, railg, rakv, fuzg, codg, tubw, flipb, trucp, tufk, topk, blaef, stakg, grovt, crusv, snakb, tastd, bonm, glazb, stuml, crabg, lamg.

Appendix 2

Long words : thousand, understand, yesterday, sometimes, everything, November, newspaper, Japanese, afternoon, breakfast.

Short words : girl, not, what, can, ago, back, his, only, six, both.

Appendix 3

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10 RT= 0
20 PRINT "old"
30 RT$ =INKEY $
40 IF RT$ =""THEN RT=RT+ 1 : GOTO 10
50 CLS
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