

Development of Graphemic Awareness and Reading Proficiency

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Abstract

This study builds on the previous study undertaken by the author investigating the development of graphemic awareness among learners of Japanese with alphabetical backgrounds. Graphemic awareness refers to an awareness that grapheme can be a unit of analysis. The findings of the preceding study showed that, unlike native speakers of Japanese, 1) learners processed kanji by direct code, 2) they were not good at segmenting kanji into each grapheme, and 3) they did not use graphemic information for accessing lexical memory. The present study looks into learners' graphemic awareness more carefully in order to investigate the relationship between the level of learners' graphemic awareness and their proficiency in reading Japanese. In this study, results of a reading comprehension test and a kanji production test were analysed. The results showed that subjects who had stronger graphemic awareness tended to get higher scores in reading comprehension test. The findings imply that there is a relationship between the development of graphemic awareness and reading proficiency.

Key Words:

kanji, word recognition, graphemic awareness, reading proficiency

1. INTRODUCTION

Research in reading suggests that word recognition is essential in reading comprehension (Koda, 1994, 1992; Adams, 1990). Higher processing such as syntactic manipulation cannot be performed without appropriate word recognition (Brisbois, 1995; Brown & Haynes, 1985).

In Japanese language learning, abundant evidence suggests that kanji word recognition is critical in reading (eg. Dobson, 1997; Okita, 1995; Hatano, 1986). Kanji word recognition requires a different type of recognition skill depending on the characteristics of a word; ie. whether the word is made up of one kanji or a compound, or whether the word is with or without okurigana (declensional kana). Nevertheless, the fundamental and the most important skill is adequate recognition of a single kanji (Okita, 1995). This paper focuses on single kanji character recognition for the above reason.

Learners with alphabetical backgrounds find kanji recognition not easy (Toyoda, 1995a). Similarly, learners of Chinese have expressed the view that reliance on the processing skills developed for alphabet-based languages hindered, rather than facilitated, learning the language (de Courcy, 1995).

2. PREVIOUS STUDIES

Research in alphabetical languages shows that there are two processing codes for word recognition:

- 1) phonological code - the code which accompanies an analysis of phonemes; and
- 2) direct code - the code which directly accesses to lexical information without going through an analysis of phonemes.

Researchers have different views on how these codes are used in relation to each other. However, their opinions are consistent that the phonological code is used for processing unfamiliar words (eg. Barron, 1981, 1978; Meyer et al, 1974).

For Japanese kanji processing, the following three codes seem to be used:

- 1) graphemic code - the code which accompanies an analysis of graphemes;
- 2) phonological code - the code which accompanies an analysis of phonemes; and
- 3) direct code - the code which directly accesses lexical information using visual image.

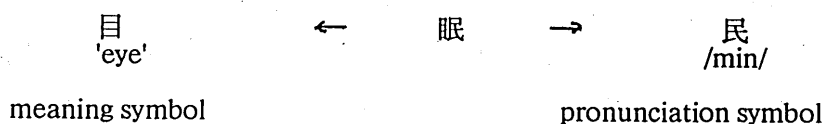
In the present paper, the importance of a graphemic code is advocated. In order to use the graphemic code to process kanji efficiently, it is required to have an awareness to look into kanji's graphemic features and functions. This awareness is called 'graphemic awareness' in this paper.

Seemingly alike single kanji characters are, in fact, of two kinds; simple and combined (Fig.1). Simple kanji are constituted by one single component, and combined kanji are made up of more than two components. A component often gives important cues for the meaning or the pronunciation of a kanji character (Fig. 2).

Figure 1 Examples of simple and combined kanji

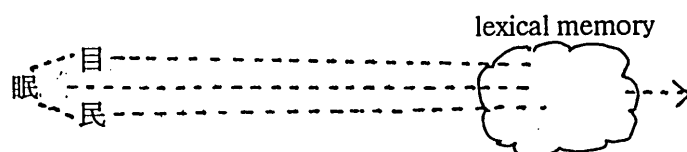
目	眠
Simple kanji	Combined kanji

Figure 2 Meaning and Pronunciation symbols for the word 'sleep'



Research suggests that native readers of Japanese access a mental lexicon of each component as they access a mental lexicon of a character (Flores d'Arcais et al, 1995; Flores d'Arcais & Saito, 1993; Flores d'Arcais, 1992). In other words, when native readers access information on the meaning and the pronunciation of a character, they access information about constituent elements of the character at the same time (Fig.3). Native readers of Japanese appear to have a high degree of graphemic awareness which is required for Japanese kanji recognition.

Figure 3 Processes of accessing lexical memory in native readers of Japanese



To clarify how learners differ from Japanese natives in processing kanji, an experiment to investigate the relationship between the production and the characteristics of kanji was conducted. In short, the findings were as follows (see Toyoda, 1995b for details).

- 1) Kanji with many strokes, a strong degree of linearity and a weak degree of symmetry tended not to be reproduced by learners.
- 2) Kanji with a weak degree of symmetry showed a positive correlation to errors in production made by learners.
- 3) Errors produced by learners were different to those produced by Japanese natives.

From the above findings of kanji retrieval from lexical memory, it was hypothesised that the learners with alphabetical backgrounds do not have adequate graphemic awareness to read kanji. The results were re-analysed from the perspective of recognition (see Toyoda, 1997 for details). The findings of this aspect of study revealed that learners with alphabetical backgrounds:

- 1) memorised kanji as a whole;
- 2) were not good at segmenting a kanji into each component; and

3) did not use the information associated with kanji components for accessing lexical memory.

These findings imply that graphemic awareness which is required for Japanese kanji recognition is insufficient in learners with alphabetical backgrounds in comparison with that of natives (Toyoda, 1997).

3. THE STUDY

The present study builds upon the above studies. Firstly, it attempted to consolidate the previous study regarding the relationship between kanji characteristics and production tendencies by analysing kanji production in beginner learners. Secondly and more importantly, it attempted to investigate the relationship between graphemic awareness and reading proficiency by comparing production and reading abilities.

3.1 Subjects and Procedure

The subjects were 92 students who had enrolled in Japanese 2A and 2B, consecutive beginner's level courses, at the University of Melbourne in 1977. Among those students, 55 students took both production and reading tests. Students who answered that they had had any experience of Chinese characters in the background survey were excluded, leaving 36 subjects whose data was analysed in the present paper.

The author devised the following two kinds of tests:

1. a kanji production test (appendix 1);
 2. a reading comprehension test (appendix 2);
- and a background survey was administered as well.

The production test was one and half pages of a kana-written passage which consists of many words that subjects had learned through the Japanese 2A course. In most of these words, at least a part had a kanji equivalent. All of these words that have kanji equivalents commonly appear in kanji form in passages that students have previously read. The learners were asked to change these kana-written words, wherever needed, into kanji-written words. The test passage was first read orally twice and subjects were asked some questions to make sure that they understood the meanings of the words before they were told to convert them into kanji. This test was administered at the beginning of the Japanese 2B course as a non-assessed class test in order to help students to review previously learned kanji words.

The reading test had two parts: one focused on kanji word recognition and the other on vocabulary and grammar comprehension. In the first part, there were passages which

consisted of many kanji written words to recognise followed by multiple choice tasks to complete. The second part was a more general reading comprehension section. There were passages to read and questions to answer with regard to these passages. The reading test was administered as a final achievement test for Japanese 2A.

The background survey was conducted at the beginning of Japanese 2A to obtain the students' background data.

3. 2. Analysis and Results 1

After the production test was administered, kanji was weighed according to the proportion of kanji produced. The number of kanji analysed here was 46 (appendix 3). For each of the 46 kanji, 0 was given if nothing was produced, 1 point if only a vague image was produced, 2 points if at least one component was produced correctly, and 3 points for correctly produced kanji (Table 1). No point was given for those characters that were correct in shape, but the wrong answers. These answers may also be an important resource for investigation. However, the obtained data was too small for analysis.

Table 1 Weighing scale

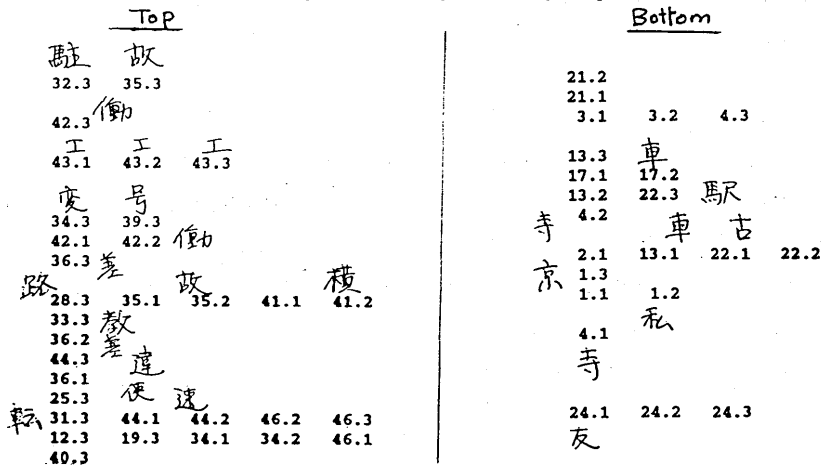
- 1 京(京) 都(都) 子(子) 寺(寺)
旅(旅) 約(約) 神(神) 新(新)
駅(駅)
- 2 都(都) 働(働) 馬(馬) 使(便)
館(館) 新(新) 駐(駐) 建(建) 違(違)
約(約) 路(路) 教(教) 地(地)
- 3

The data were then analysed using the Rasch based program 'Quest' (see Adams & Khoo, 1993 for details) to measure the performance of this test. The Rasch analyses estimates a mathematical relationship between person ability and item difficulty, and expresses this relationship as the probability of a certain response (McNamara, 1996). Overall, the test had high reliability (Cronbach's Alpha was 0.94) that is the test was able to distinguish between subjects in their kanji production ability.

The program also shows kanji difficulty. The following 'map' tells not only that one kanji is more difficult than another, but also how much more difficult it is (Fig.4). The characters which appeared near the top of the map were harder for the subjects to produce. These characters, except only one character '工', were asymmetrical kanji,

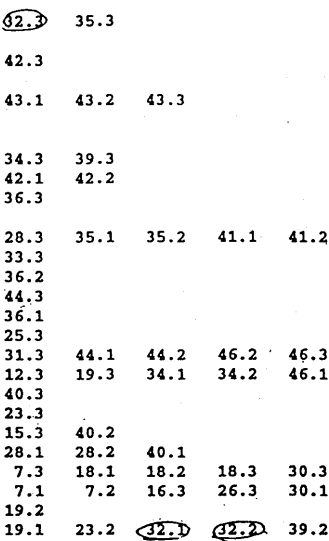
namely the type that were found to be difficult in the previous study. Symmetrical kanji, on the other hand, tended to appear near the bottom of the map.

Figure 4 Kanji difficulty map



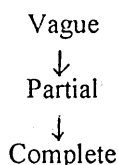
By looking at this map more closely, interesting phenomena were observed. Where the same kanji appears in different places on the map, this indicates that there are differences in the level of difficulty involved in partial or complete production of the kanji (Fig.5). For example, a similar level of difficulty was involved for students to gain 1 or 2 points in partially producing kanji # 32, the character ‘駐’. However, gaining 3 points for production of the complete kanji involved much greater level of difficulty. Those kanji which had the greatest distance between the partially and the completely produced forms were asymmetrical combined kanji.

Figure 5 Level of difficulty involved in partial or complete production



It should be noted that, in most cases, point 1 appeared in the lowest position, then 2 and 3 followed. This fact suggests that the learners usually take steps from the stage where they can produce kanji vaguely, then partially, and completely (Fig.6). There were some cases where gaining 1 and 2 or 2 and 3 points appeared to involve the same level of difficulty, but no reverse case.

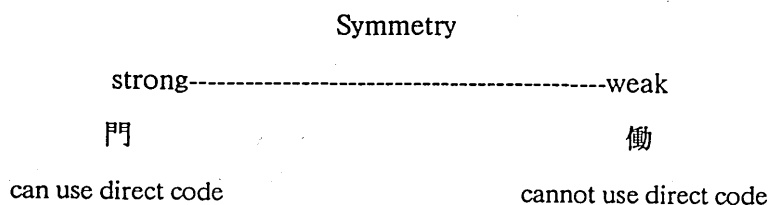
Figure 6 Stages in production



3.3. Discussion

The above findings all support the findings of the previous study. It appears that learners with alphabetical backgrounds have difficulty in producing complex, combined kanji. In the previous study, by comparing errors of learners with those of natives, it was concluded that there was a difference in processing performance between the two groups, and due to this difference in processing style, the learners' production showed a certain tendency, ie. there was greater difficulty in producing kanji which have opposite features of alphabets (Toyoda, 1997). Learners who have been used to processing alphabets, at first may try to process unfamiliar words phonologically. However, because kanji, especially those with kun-reading (Japanese-reading) give no clue for the pronunciation, it is impossible to use phonological code to process these kanji. It could be speculated that learners use direct code to access the meaning of kanji. This method works well for simple, symmetrical or semi-symmetrical kanji as they can easily be recognised as a whole. However, learners need to be sensitised to features and functions of kanji components; to be able to recognise more complicated forms. In other words, learners must have a good graphemic awareness which is suitable for Japanese kanji processing (Fig.7).

Figure 7 Relationship of symmetry to ease of processing kanji



It seems that there are developmental stages in learners' graphemic awareness. Given that there were stages from vague to complete in production, there are developmental stages in graphemic awareness which range from being very far to very near to the abilities of native readers of Japanese.

3.4. Analysis and Results 2

It is not an easy task to measure a degree of graphemic awareness in learners. Since there was no appropriate test to more directly measure graphemic awareness that is required in reading Japanese, in this study, the results of the production test were used to measure their graphemic awareness. The route that learners take to produce kanji from lexical memory is the same processing route from visual stimuli to lexical memory, but in reverse. The degree of graphemic awareness must affect these routes in both ways. It is conceivable that the higher graphemic awareness is required as going from vague image level to complete production level. In this study, learners' scores on a production test and scores on a reading test were compared to investigate the relationship between graphemic awareness and reading ability. It was expected that the higher the graphemic awareness, the better reading performance.

The results showed that there was a significant correlation between these test scores ($n=36$, $r=.648$). The production test scores were then compared with Part 1 and Part 2 of the reading test respectively. Since Part 1 had a collection of questions which focused on kanji word recognition, it was expected that correlation with Part 1 of the reading test would be higher than that with Part 2, where more general questions were provided. The results showed, as expected, that the correlation was $r=.634$ with Part 1, and $r=.546$ with Part 2 (Table 2).

Table 2 Correlation between production test and reading test

		n	r
Production Test	x Reading Test (Total)	36	.648
Production Test	x Reading (Part 1)	36	.634
Production Test	x Reading (Part 2)	36	.546

3.5. Discussion

The above results show that there is a significant relationship between the degree of graphemic awareness and reading ability. Learners with higher graphemic awareness tend to do better in reading. However, the correlation is not a strong one. Although kanji recognition may play an essential role in reading in Japanese, reading activity surely involves other factors besides word recognition regardless of difference between

languages. The fact that the correlation between the production and Part 1 reading is higher than that with Part 2 (more general comprehension) supports the above statement.

4. CONCLUSION

In this study, learners' cognitive processes and degrees of graphemic awareness were investigated through kanji production. The findings of the study support the previous findings that complex, and combined kanji are difficult for learners with alphabetical backgrounds to process. The results of the present study imply that learners may have graphemic awareness that is very far from that of native Japanese at the beginning stage, and may acquire higher graphemic awareness that is very similar to that of native Japanese at a later stage.

This study also attempted to investigate the relationship between graphemic awareness and reading proficiency. The findings show that the correlation between the degree of graphemic awareness and reading ability is significant, but not strong. Given that reading comprehension involves factors other than kanji recognition, this finding is inevitable. There requires many different skills in reading activities, both universal and Japanese language specific skills (Moore, 1996). The universal skills include: 1) using cues in the text, 2) applying linguistic knowledge, and 3) applying real world knowledge. The Japanese language specific skills include: 1) using information of known kanji, 2) using information of graphemes, 3) applying knowledge on kanji components (ie. relationship between kanji characters), and 4) applying knowledge on okurigana, declensional kana.(ie. word class).

This study focused on single kanji recognition as it is the fundamenta and the most important skill. However, it is also necessary to focus on kanji compounds (a word consists of two or more kanji) and word with okurigana (declensional kana) in order to fully investigate the contribution of word recognition to reading comprehension. Finally, the method used in this study to measure graphemic awareness may not be the best one. Development of a test for more direct measurement of graphemic awareness will be undertaken for future research.

NOTES

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APPENDIX

1. Production Test

なつやすみにきょうとへいきました。きょうとには、ふるい
おてらやじんじやがたくさんありますが、あたらしいたの
たくさんあります。しなにはしでん（トラム）がはしってい
す。きょうとにいったとき、わたしは、りよかんにとまろうと
おもって、よくしておいたのですが、ともだちが「わたしの
いえにとまってください」といってくれたので、ともだちのいえ
にとめてもらいました。
ともだちのいえは、きょうとえきからふたつめのえきでおりて、
バスで40ぶんぐらいのところにあります。えきからでんわを

2. Reading Test (Part 1)

5 町田さん、山中さん and 高木さん are looking for a house to rent. Which house is the most suitable house for each of them. Write the alphabet from a) to d) on the answer sheet. (6 marks)

- | | |
|------|--|
| 町田さん | 「新しくなくてもいいから、広いほうがいいなあ。学校に近くて買い物にも便利で、それから、近くに子どもたちがあそべる公園があったらいいなあ。」 |
| 山中さん | 「メルボルンには一年ぐらいいかないから、ソファとかテーブルとか何でも付いている家がいいなあ。それに、車を持っていないから、交通の便がよくなければだめだわ。」 |
| 高木さん | 「家族が多いから大きい家を借りなければならないな。広いおふろで、スバがついていたらいいなあ。大きい庭もほしいなあ。それからよくお客さんが来るから、お客さんのための駐車場もあったらいいね。」 |
| a. | 一戸建て、庭付き。4寝室2書斎。2台用ガレージ。家具付き。市内まで車で15分。週400ドル。 |
| b. | 新築タウンハウス。広くてモダンで便所。モダンなデザインの寝室、2部屋。広い浴室。スバ付き。週350ドル。 |
| c. | 2階建てのゆとりのある家。庭付き。大きな4寝室。美しいLandcox Parkのとなり。週300ドル。 |
| d. | モダンな家具付きフラット。2寝室。市内まで車で15分。トラムの駅まで歩いて3分。スーパーすぐ近く。週300。 |

(Part 2)

お手紙ありがとうございました。きのうまでテストのための勉強をしたりエッセーを書いたりしなければならなかったので、手紙が書けませんでした。すみませんでした。今日からもう何もないので、とてもうれしいです。

あしたから、友だちと長いヨーロッパ旅行に出かけます。ひろしさんはヨーロッパを旅したことがありますか。出かける前にしておかなければならないことがたくさんあります。

少し前に旅行会社に行って帰ってきたところです。お金をはらって、ひこうきのきっぷをもらってきました。ホテルの予約もしてもらいましたから、だいじょうぶです。

今からにもつをかばんにつめようと思っています。Tシャツやくつしたを入れて、それから、セーターも入れたほうがいいでしょう。タオルは持っていなくてもいいと思いますが、かおを洗った時に使うために、1まいだけ持っていくことにします。持っていく食べ物、きのう買ってきて、もうかばんに入れてあります。れいぞうこにチョコレートがたくさん入っているの、それも少し持っていこうと思います。でも、これは、あした出かける時に、れいぞうこから出したほうがいいですね。

旅行会社から帰ってきた時にポストを見たら、友だちから手紙が来ていました。これもかばんに入れて持っていきます。ひこうきの中で読もうと思っています。家にいない時に新聞や手紙が来てはいけなないので、あしたからは、となりの人にたのんできてもらうことにしました。

ペットのねこは、となりの人にあずけようと思っていたのですが、となりの人が「う

Choose the most appropriate answer for the following questions, and write down the alphabet of the answer.

- 1 Why did Marie go to the travel agency?
 - a ホテルにとまるために行きました。
 - b ホテルのお金をはらうために行きました。
 - c ひこうきのきっぷをもらうために行きました。
 - d ひこうきのきっぷを予約するために行きました。
- 2 What does the person next door do for Marie while she is away?
 - a ポストを見る。
 - b ねこをあずかる。
 - c にわのそうじをする。
 - d かぎをかける。

3. Target Kanji

目止自差違
曲駅利故速
内乗便変工
社館友教働
神旅建駐横
寺車古転走
都約新通号
京予図交信
私所地路点反