



An Analysis of L2 Readers' Comments on Kanji Recognition

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Abstract

The paper investigated how adult L2 readers with an alphabetic language background learning a language that is orthographically distinctive from their L1, develop awareness of the structural and functional properties of small units of the unfamiliar script. The focus of the present paper is on developing awareness of the structural and functional properties of sub-character units (components) of *kanji*, Chinese characters used in Japanese. Participants with different levels of *kanji* knowledge were asked to verbally account for their performance in *kanji* processing tasks. Overall, interview data suggest that L2 readers gradually develop their awareness of components in four aspects: positions and combinations, semantic function, phonological function and the limitations of the functions. The data further suggest the following points: The awareness is not absolute, but improves as exposure to the script increases. Rudimentary awareness begins to emerge very early and develops in a sequence dictated by the orthographic principles. In the process of the development, the focal point of the awareness shifts from global to local, and the awareness, once perfected, goes background.

1 Background

Learning to read words quickly and accurately is critical for reading proficiency. Without efficient word recognition, both syntactic- and discourse-level processing will be jeopardized (Vellutino, 1991; Stanovich, 1991; Brisbois, 1995). Perfetti (2003) states that learning to read is to be aware of how the writing system works with regard to both basic principles and details of its orthographic implementation. Understanding the segmental nature of words is especially critical for reading efficiency. A lack of such awareness restricts lexical inference and retention (Koda, 2002). In learning to read words, children develop an awareness of the structural and functional properties of sub-word units, which facilitates the development of word recognition skills (Shu & Anderson, 1998).

Although the developmental pathway may not be the same as that of first language (L1) children, adult second language (L2) learners learning to read in L2 also have to develop awareness of the structural and functional properties of small units that are appropriate for the new script, since processing strategies will be regulated by such awareness. While numerous studies indicate that L2 readers utilise cognitive skills developed in their L1 when reading in their L2 (e.g. Gottardo, Yan, Siegel, & Wade-Wooley, 2001; Holm & Dodd, 1996), some studies suggest that L2 readers gradually develop L2-specific awareness of the structural and functional properties of components through building knowledge of L2 orthographic features (e.g. Ke, 1998; Koda, 1999a). However research is limited on how adult L2 readers with an alphabetic language background learning a language that is orthographically distinctive from their L1 develop an awareness of the structural and functional properties of small units of the unfamiliar script.

2 Present study

The present article examines the developmental awareness of the structural and functional properties in adult L2 readers of *kanji*, Chinese characters used in Japanese. As it deals with *kanji*, the focus is on awareness of the structural and functional properties of sub-character units, or components. Through analyses of *kanji* and with support from research findings (which will be briefly discussed shortly), the following four aspects of awareness were identified as being critical to *kanji* recognition.

- *Awareness of component positions and combinations*

Characters can be grouped into four patterns according to their graphical configuration (Nomura, 1984): non-separable (e.g. 日); left-right (e.g. 明); top-bottom (e.g. 星); and others (e.g. 間). However, the majority are compound characters, consisting of two functional components. One is a semantic indicator depicting a semantic category (referred to as a ‘radical’ in this article), while the other may be a phonetic indicator called ‘phonetic’. The character 語 (word /go/), for example, is a compound character with a radical 言 (speech) and a phonetic 吾 /go/.

Radical	Character	Phonetic
言 (speech)	< 語 (word /go/) >	吾 /go/.

Knowing the positions of radicals is essential for accessing their semantic information, and for finding phonetics and retrieving their phonological information. In most cases, radicals have a preferred, if not fixed, position. For example, the radical 言 usually appears on the left side of the character. The positions of phonetics are generally determined by the radicals (i.e. on the non-radical side). Since radicals and phonetics carry useful information for the recognition of *kanji*, it is expected that readers of *kanji* will develop awareness of their positions.

- *Awareness of the function of radicals in compound characters*

As mentioned above, the radical of a character indicates a semantic category (a broad meaning field) to which the character belongs. Semantic relationships between a character and its radical, and between a radical and the characters sharing it are sometimes unclear (Flores d'Arcais, Saito, & Kawasaki, 1995) unless the generic meanings of characters and components are known. 語 “word” and 誰 “who” share the same radical 言 “speech”, but these are hard to relate to each other. Nevertheless, the information conveyed by the radical can be helpful in accessing the meaning of *kanji*. For example, the characters, 語 (word), 話 (speak/story), and 読 (read) share a common radical 言 (speech), and are semantically somewhat related. The meaning of a character cannot be inferred from its radical, but the semantic information of the radical can aid categorisation of the character, possibly helping to access the meaning of the *kanji*.

- *Awareness of the function of phonetics in compound characters*

The reading of a *kanji* could be one of, or a mixture of, two types of readings: on-reading and kun-reading. When Chinese characters were introduced to Japan, there were sometimes no Japanese concepts for the in-coming new Chinese words. In such cases, characters and their readings were used to represent Chinese objects, ideas or events, although the original readings in Chinese were altered to suit the Japanese phonological system (Martin, 1972; Hirose, 1998).

These readings are on-readings. In other cases, however, characters were used to represent native words that already existed in Japan (Martin, 1972; Hirose, 1998). These readings are kun-readings.

語 /go/ (word)	/go/	< On-reading
	/kata-ru/ (to tell)	< Kun-reading

As mentioned, in compound characters, the non-radical components may have useful phonological information when they function as 'phonetics'. While not all compound characters have a phonetic, its sound can be identical or similar to that of the on-reading of *kanji* containing the same phonetic. For example, the phonetic 工 indicates the sound /koR/, and the characters containing this phonetic, such as 功, 項, 巧, 紅, and 貢, have the on-reading /koR/. A less consistent phonetic is, for example, 每 /mai/. The *kanji* with this phonetic 海 and 悔, are read as /kai/, 梅 is read as /bai/, but 悔 is read as /bu/. Thus, although the phonetic may not indicate the reading of the *kanji*, the sound of the phonetic often rhymes with the reading of the *kanji* (Jackson, Lu, & Ju 1994). Given the usefulness of the phonetics, it is plausible that the awareness develop in readers.

- *Awareness of the limitations of component information*

As described above, information conveyed by functional components (radicals and phonetics) is not always reliable. Therefore, it is reasonable to conjecture that readers, as their vocabulary grows, develop awareness of the limitations of component information.

Research suggests that L1 morphographic children gradually become aware in these four aspects of component information: positions and combinations (e.g. Shu & Anderson, 1998), semantic function (e.g. Shu & Anderson, 1997), phonological function (e.g. Shu, Anderson, & Wu, 2000) and the limitations of the functions (e.g. Ho & Bryant, 1997).

Shu and Anderson (1998) conducted an experiment investigating the effect of the component position on Chinese children. They asked Chinese L1 readers (Grades 1, 2, 4 and 6) to judge which of a series of items could be or could not be Chinese characters. The judgement on the artificial characters with the wrong combination of two components in their correct positions was not easy for the children across all the age groups. However, for the artificial characters with two components in illegitimate positions, there was a decline in misjudgement for the older children (in Grades 4 and 6), while the younger children performed in this set poorly. Shu and Anderson interpreted these results by suggesting that L1 readers gradually develop awareness of the detailed internal structure of characters.

Shu and Anderson (1997) investigated the development of radical awareness in Chinese children (Grades 3 and 5), who were divided into three groups (high, average and low) according to their reading ability. The participants were presented with compound words that were made of one Chinese character, and alphabetic letters to show the reading of the other character. The task was to find an appropriate character to replace the alphabetic letters from a list of four characters, all of which were unfamiliar to them. The results showed that regardless of age groups the children with higher reading ability did better than those of lower ability for the unfamiliar characters that had transparent familiar main radicals. The children with higher reading ability may have been aware that the meaning of a character could be inferred from the meaning of its main radical, whereas the children with lower reading ability may not.

Shu, Anderson and Wu (2000) investigated whether Chinese children use the phonological information of phonetics for pronunciation of characters by asking Chinese children (Grades 2, 4, and 6) to name characters as quickly as possible. The results showed that the older children made more errors in naming irregular characters (the reading of the character was different from the reading of its phonetic) than the younger children, because the older children had given irregular

characters the same pronunciations as their phonetics. Another common error was caused by mispronouncing a character with a bound phonetic (phonetics that cannot be stand-alone characters) through an analogy with another character with a different pronunciation that contained the same phonetic. Shu et al. argue that phonetic awareness continues to develop over the elementary school years, as shown by the increasing influence of phonetic regularity on the performance of children in higher grades and the increasing percentage of phonetic-related errors among older children.

Ho and Bryant (1997) investigated Chinese children's ability (Grades 1 and 2) to utilise phonetic awareness in reading compound characters with different regularities. The results showed that the Grade 2 children outperformed the Grade 1 children in artificial character reading (the artificial characters contained a phonologically regular phonetic), suggesting that the older children had a greater ability to use the phonetic to infer the reading than the younger children. It was therefore expected that the Grade 2 children would perform well in real character reading (the distance between the pronunciations of the character and its phonetic varied). Interestingly, however, the Grade 2 children made more errors than the Grade 1 children in reading the characters with an irregular phonetic. Based on these findings, Ho and Bryant claimed that experienced readers have awareness of the limitations of component information.

The results obtained in the above study were inconsistent with the findings in the study by Shu et al. (2000), which found a larger influence of phonetic regularity of unfamiliar compound characters on the performance of children in higher grades. This was probably because the familiarity of characters was not controlled in the study by Ho and Bryant. As the same set of compound characters was used for both the first and second grade children, the older children could have known the pronunciations of some irregular compound characters. Hence, less regularity effect was observed. In this sense, the conclusion drawn in the study by Ho and Bryant that second graders have the awareness of the limitations of component information is somewhat questionable. Nevertheless, if indeed the phonological information of phonetics could be activated, it is likely that children would face inconsistent information from the character and from its irregular phonetic, and therefore eventually become aware that phonetics are only occasionally useful for inferring the readings of characters.

In the L2 context, as a related case, Jackson, Chen, Goldsberry, Kim and Vanderwerff (1999) reported the importance of L2 processing experience for L2-specific recognition skills development. Jackson et al. investigated whether three groups of L2 readers with non-alphabetic home backgrounds (Korea, Taiwan and Hong Kong) showed any reliance on L1-specific processing procedures in reading English (L2) passages in different conditions. The results showed that while all the L2 groups with non-alphabetic backgrounds were impaired when orthographic cues were disrupted by mixed case words, the group from Hong Kong, who had the longest exposure to English, were less affected compared to the other two groups. This study suggests that exposure to a L2 writing system does facilitate the improvement in the L2-specific processing skills.

Chikamatsu (2006) investigated whether or not *kana* (syllabic) word recognition strategies shift from phonological processing to more orthographic processing in L1-English, L2-Japanese participants. The results of context-free lexical judgement tasks controlled by visual familiarity showed that her participants with more experience of Japanese reading relied less on phonological processing and used more orthographic information than less experienced readers, which suggest that the L2 word recognition strategy is developmental and reconstructed as proficiency advances.

By reviewing a number of previous studies of L2 recognition skills including the above, Koda (1999b) proposes the gradual development of awareness of the structural and functional properties of sub-character units in adult L2 morphology readers. Ke (1998) mentions his model of the three developmental stages of awareness in L2 morphology readers. The three stages are 1) the accumulation stage, 2) the transitional stage, and 3) the component-processing stage. Koda suggests a further stage by claiming the importance of the development of the abilities to detect component information validity. However, to date, studies, particularly those focusing on L2 morphology readers' awareness, are still limited.

In this article, I will show that L2 readers with alphabetic backgrounds become aware of the above-mentioned four aspects of information conveyed by components in a developmental se-

quence similar to that of L1 children learning to read in morphography. Conventionally, awareness in relation to word recognition has been studied using behavioral tasks. However, as adult L2 readers are metacognitively more developed than young children, it is viable to ask them to verbalize their awareness. They may be able to provide insightful information on how they process words. The present article attempts to address the developing awareness by directly delving into the L2 readers' conscious thinking through their verbalization of their awareness. Precisely, a retrospective interview was employed to elicit the participants' awareness, using the character recognition tasks as stimuli. Talking about their performance required a conscious analysis of the automatic processes required in timed tasks, bringing interviewees' awareness to the conscious level. Some researchers refer to this *explicit conscious representation of the latent awareness* as metalinguistic awareness, claimed to be related to linguistic development, especially to development of literacy (Birdsong, 1989; Herriman, 1991; Alderson, 2000). Thus, the present study investigates the L2 readers' developing awareness of the structural and functional properties of components in *kanji* via their metalinguistic accounts.

3 Methods

3.1 Participants

103 graduate and undergraduate university students from five Australian universities who are learning or have learned Japanese participated in the study. In all cases, English was the language in which they felt most comfortable both in speaking and reading, regardless of their first language. Out of the 103 students, 49 had some knowledge of alphabetic language(s) other than English, but none spoke or read morphographic languages, apart from Japanese (see Appendix A). The participants learn or have learned *kanji* mostly in a classroom situation. Although the *kanji* teaching method may not be identical across institutions, in most cases, students are introduced to new *kanji* in the form of a word list, and are asked to practise reading and writing in their own spare time. All participants have received a few hours of introduction to the components of *kanji* at an early stage of *kanji* learning.

As the data were to be analysed with respect to *kanji* vocabulary size, three broad levels were selected. Conventionally, learners of Japanese are classified into three levels of proficiency in knowing *kanji*: beginner (*kanji* vocabulary size is at Levels 3 and 4 of the Japanese Proficiency Test, fewer than 300 characters); intermediate (Level 2, 300-1000 characters); and advanced (greater than 1000 characters). Participants were classified according to the results of a simple *kanji* vocabulary test employing a self-checklist. In a vocabulary size test, a large sample is a typical requirement in order to achieve reliable estimates (Nation, 1993). Also, it is desirable to have a test that can measure vocabulary size in a short period of time (Read, 1993). Well suited to these requirements is a checklist test, which presents test-takers with a series of words and simply asks them to indicate whether they know each one or not (Read, 2000).

The *kanji* vocabulary test was created using a *kanji* database that contained data from the standardised Japanese Proficiency Test (日本語能力試験). *The Database for the 1,945 Basic Japanese Kanji, 2nd edition* (Tamaoka, Kirsner, Yanase, Miyaoka, and Kawakami, 2002), consisted of 1,945 *kanji* with levels of the standardised proficiency test, the difficulty of which had been determined by two organisations, the Japan Foundation and the Association of International Education, in 1993. The test consisted of three lists of *kanji* drawn from the beginner, intermediate and advanced levels; participants ticked any *kanji* that they knew. The final group of participants consisted of 39 beginner, 37 intermediate and 27 advanced L2 readers of *kanji*. The length of the time they have/had learned Japanese varied widely within each group.

A further group of L1 readers of Japanese was also included as a baseline. The most skilled group consisted of 16 native speakers of Japanese, also fluent in English (Japanese-dominant bilinguals). All of the L1 readers completed at least nine years of compulsory education in Japan. The length of time they had lived in an English-speaking environment varied, but for all, Japanese

was the most comfortable language in speaking and reading. Out of the 16 L1 readers, six also had some knowledge of alphabetic language(s) other than English, but none had knowledge of morphographic languages other than Japanese.

3.2 *Materials and procedure*

Six tasks were devised to stimulate the participants' awareness, and thus act as stimuli for the interview. All the tasks were essentially artificial, differing from normal reading and focusing on three essential aspects of *kanji* recognition, orthographic, phonological and semantic properties, respectively. There were two orthographic tasks ('real-artificial' and 'radical identification'), two semantic tasks ('same-different meaning' and 'meaning categorization') and two phonological tasks ('same-different sound' and 'sound matching'). The section to follow describes the tasks briefly.

In the real-artificial task, real *kanji* (e.g. 較) or made-up characters (the components had been relocated - e.g. 主厶) were shown on the computer monitor one by one, and each time participants were required to judge whether the stimulus was a real *kanji*. The radical identification task required judgement of whether there was a common radical in two *kanji* (e.g. 郎 邸). The same-different meaning task required participants to judge whether two *kanji* with or without a common radical were semantically related (e.g. 吸 吹). In the meaning categorization task, they were required to judge whether the *kanji* was related to the meaning category shown by a radical (e.g. 雪 rain). The radicals were either those used in the *kanji* shown or those of another *kanji*. The same-different sound task was required participants to judge whether the two *kanji* (e.g. 腹 復) had the same reading. In the sound matching task, one *kanji* was shown on the monitor followed by a sound (written in Roman alphabet). For each pair of a *kanji* and a sound (e.g. 迫 ha-ku), participants were required to judge whether the *kanji* had the sound displayed. The results of these tasks will be reported on a separate occasion due to the limited scope of this article.

In order to elicit participants' awareness, individual interviews were conducted in the form of a retrospective "think aloud" report (also referred to as retrospective protocol or episodic recollection in Pressley & Afflerback, 1995), the advantage being that it can provide data about thought processes that could otherwise be only inferred from performance. It also provides access to the overt reasoning processes that presumably underlie sophisticated cognition, response, and decision making (Pressley & Afflerback, 1995). Every participant was interviewed immediately after each of six tasks. In this way, the investigator did not need to guide the participants in order to obtain information, as they would have had the necessary retrieval cues in their recent memory (Ericsson & Simon, 1984; Gass, 2001).

As the purpose of the interview was to examine the participant's awareness, leading questions were avoided as much as possible. The questions asked were "How did you go about this task?" and "Can you tell me what you were doing in this task?". Some further questions were asked for situations where participants' responses were irrelevant to the aspects of awareness. Those questions included: "Was there any particular part that you were focusing on?" and "If you made a guess, based on what sort of information did you guess?" Each interview was kept brief (2-3 min) to avoid the possible negative effect of fatigue on the following task. Interviews were conducted in the language in which the participants felt most comfortable.

The audio-taped interview was transcribed and then examined for four aspects of awareness: 1) component positions and combinations; 2) the function of radicals; 3) the function of phonetics; and 4) the limitations of component information. In reporting, descriptive comparisons were made between the different groups of *kanji* vocabulary levels, and also between the L1 and L2 readers. The number of remarks made is given for reference. However, it should be noted that the remarks were made freely without guided questioning. Therefore the numbers do not reflect the significance of a particular view of the participants.

4 Results and discussion

4.1 Development of awareness of component positions and combinations

One of the most intriguing findings obtained from the interview data with the L2 readers of Japanese was that, despite their limited exposure to *kanji*, some *beginner* L2 readers (with knowledge of less than 300 *kanji*) were vaguely aware of component positions and combinations. 11 remarks (out of 32 comments on the real-artificial task) suggested that some participants identified wrongly placed components (see example 1 below). When asked to find a common radical, four remarks (out of 30 comments on the radical identification task) suggest that some might have known where to focus, as exemplified in example 2.

- 1) I recognized some parts of them, but I thought they were not in the right places where they should be.
- 2) Sometimes, the middle part was different, but most of the time, the difference was either on the left or at the top.

On the other hand, four remarks show that the participants were not confident at all in their judgement, because they knew their *kanji* vocabulary was too limited for any sensible judgement (see example 3).

- 3) I thought it was difficult in that it's very possible that some *kanji* could exist but I just don't know them.

While some beginner L2 readers seemed to have developed a rudimentary awareness of component positions and combinations, it should be noted that six participants remarked that they did not have a clear idea why the *kanji* looked wrong (see example 4) and that they looked at the *kanji* as a whole without knowing where to focus (see example 5).

- 4) If the *kanji* looked ugly or it didn't have some symmetry to it, or looked awkward to what I've seen before, then I would tend to give it as not correct.
- 5) I found the task very hard because I didn't have enough time to look at all the different elements. So a lot of time, if I thought I saw similar shapes, I said 'yes'.

In contrast to the beginner L2 readers, 14 remarks by the *intermediate* L2 readers (out of 20 comments on the real-artificial task) demonstrate that these readers were able to detect the abnormality of wrongly placed components (see example 6). There were no remarks showing the hesitancy of their judgements. Seven remarks (out of 20 comments on the radical identification task) suggest that some intermediate readers were aware that the radical tends to appear on the left or at the top, and those were the places they focused on (see example 7). Four participants expressed that it was easier to identify a common radical if the radical appeared in the same location in both *kanji* (see example 8).

- 6) I didn't know a lot of the *kanji*, but I could tell whether they were wrong or not by the radicals, like some radicals, you know they have to sit at the top, or on the left or right side of the character, but if they were in a wrong spot, then I could tell that it wasn't a real *kanji*.
- 7) I looked specifically for the radical. Usually, the main component is located on the left part of the *kanji*, but sometimes it can come at the top or other parts.
- 8) If the same radical was on the same spot, it was a lot easier to pick. If one radical was on the left-hand side of one character and that radical was on the left of the other character, it was easy to pick.

Judging from the interview data, it is safe to conclude that the majority of the intermediate L2 readers were aware of component positions and combinations. However, it is worth noting that

remarks made by four participants indicate that some looked at *kanji* as a whole rather than as a combination of components (see example 9).

- 9) It was hard to see all the components. It was hard to try to take a picture of each component.

In the case of the *advanced* L2 readers, 10 remarks (out of 17 comments on the real-artificial task) suggest that they were aware of the typical positions of the components (see example 10). No remarks showed otherwise. When asked to identify a common component, nine remarks (out of 17 comments on the radical identification task) indicate that the participants looked particularly for a radical. When they focused on the components, the advanced readers paid attention to details. Four out of these nine participants reported that they identified graphically similar radicals as two separate radicals (see example 11). In their remarks, radicals were often mentioned by their names as can be seen in examples 10 and 11. This is a distinct difference from the intermediate L2 readers.

- 10) Some were clearly wrong because they had the left radical on the right or the top radical at the bottom, the bottom radical at the top, like kokoro [the 'heart' radical that usually appears at the bottom] at the top or kihen [the 'tree' radical that usually appears on the left] on the right. So I think I could tell pretty quickly that those were wrong.
- 11) When the two radicals were similar, for instance, like ninben [人, the person radical] and you-ninben [足, the steps radical] I said that they were different, but in fact, they had a common component in them, so it really depends on what you think is the same and what is different.

Another interesting aspect was that three advanced participants reported reading out the *kanji* or the radicals, in order to perform orthographic tasks (real-artificial and finding-radical tasks), in which phonological processing was not required (see example 12). This was another prominent difference between the advanced readers and the intermediate readers.

- 12) I would try to recognize it and say it in my head because I needed to remember and compare it with the second one. It was so quick. I think I was reading the first one, but I was looking at the second one, and trying to remember what the component was in the first one.

It appears that the phonological processing that was observed in the advanced L2 readers was more of a common practice for L1 readers. Seven out of 16 participants reported that they used the phonological code either by reading the *kanji* in its *kun*-reading (Japanese-originated reading) or by reading the radical (see example 13).

- 13) For those ones, I usually remembered the meaning of *kanji* by reading them in the *kun*-reading, and had to retrieve the forms from memory to compare with the second *kanji*.

The majority of the L1 readers was fully aware of component positions and combinations, and knew where to find the radicals (see example 14).

- 14) I was mainly looking at the left or top parts of the character because that's where you usually find the radical.

As demonstrated in the remarks obtained from the readers with different levels of exposure to *kanji*, there was a clear relationship between the amount of exposure to *kanji* and the development of awareness of functional components.

4.2 Development of Awareness of the function of radicals of compound characters

28 remarks (out of 38 comments on the same-different meaning and meaning categorization tasks) indicate that the *beginner* L2 readers utilized 'parts' that indicated meanings. Eight of the remarks show that these readers used the 'familiar' parts of the *kanji*, without actually knowing their semantic functions, for their determination of the semantic relationship between two *kanji* or

between *kanji* and semantic category names (see example 1). Example 2 shows that, when asked to judge the semantic relationship between *kanji* and semantic categories, some might have done the meaning categorization task in a way that was not intended. Instead of processing the *kanji* and then comparing it with the category name, some of them seemed to use the category names to connect with the *kanji* (see example 2).

- 1) I had difficulty recognizing what the kanji meant. I sometimes used similar parts for guessing.
- 2) I know that the kanji were made out of pictures, so I tried to look for parts in which I could see the picture of the English word [category name] in it.

However, not all the beginner L2 readers were at the pre-awareness level. 20 remarks suggest an awareness that the radical of a character could indicate a meaning, although the degree of awareness varies (see example 3). Five out of the 20 remarks suggest that a few beginner L2 readers knew the semantic categories indicated by a few frequently-appearing radicals, such as 'water' and 'strength' (see example 4).

- 3) When I didn't know one of or both of the kanji, usually I looked for one part that I could associate with a type of word. If the other kanji that I didn't know also had that part, I said that the two kanji were in the same group.
- 4) I could try and pick the meanings by the radicals, like the one for 'water' or the one for 'strength'. But even for the ones that I didn't know, if there was a common radical I just assumed that they would have similar meanings.

It appears that rudimentary radical awareness begins to develop at an early stage of *kanji* learning.

The majority of the *intermediate* L2 readers were aware that the radical of a character indicated a semantic field. 51 remarks (of the total of 80 comments on the same-different meaning and meaning categorization tasks) indicate that the intermediate L2 readers relied on the semantic function of the radicals for their judgement when they didn't know the meanings of the *kanji* (see example 5).

- 5) For the ones I didn't know, I looked for the parts of the kanji that I knew like 'fire' and 'heart' and things. I thought that it might have a chance because they were important parts of kanji, and they might influence what the meanings of the kanji were.

It was intriguing that only seven *advanced* L2 readers reported using the radicals for their semantic judgements. This was probably because they judged the semantic relationship mainly at the character level rather than to rely heavily on the information from the radicals, as will be described later. Example 6 is one of the few that suggest that the participants relied on the radicals.

- 6) I sometimes guessed based on the radicals, like when I saw ninben [the person radical], and it said 'person', then even when I didn't know what the kanji really was, that's what vaguely I thought it was.

From the *L1 readers*, there were no remarks indicating reliance on the radicals of *kanji* for their semantic judgements.

4.3 Development of Awareness of the function of phonetics of compound characters

There were no remarks suggesting that *beginner* L2 readers were aware of phonetics. 13 remarks (out of 39 comments on the same-different sound and sound matching tasks) indicate otherwise. Four participants said they had no way to deal with the phonological tasks (see example 1). The rest seemed to have used familiar parts for their judgements (or guessing) as a desperate strategy rather than based on awareness (see example 2).

- 1) Because I didn't know most of the kanji, I thought it was pointless to do this task, because you had to know how to read them, so it didn't make sense to try and read new kanji.
- 2) I was trying to see if there were any parts that I could recognize just hoping that could be read the same way.

It was interesting to see how the beginner L2 readers tried to make sense of their judgements by reading *kanji* using the radicals (see example 3). The remarks made by three participants indicate that there were some beginner L2 readers who used the radical, which itself had no useful phonological information, as a reading aid.

- 3) If the part showing had something to do with 'fire' [the 'fire' radical] for example, then could it be pronounced /ka/ [i.e., the reading of the kanji 'fire']? I recognized in a couple of them part of kanji that could be read like that.

Some radicals can become legitimate *kanji* with slight changes in size and shape. The 'fire' radical mentioned in example 3, for example, can be a *kanji* when it is written in a full size (火), and /ka/ is one of the readings of this *kanji*. In order to tackle the phonological task, the beginner readers who had no knowledge of phonetics relied on anything that could give them phonological information. For them, it was a familiar *kanji*-like shape that was represented by the radical of the *kanji*.

At the *intermediate* level, 10 remarks (out of 40 comments on the same-different sound and sound matching tasks) suggest that some participants were not yet aware of the phonetics, although the degree of unawareness varies (see examples 4-6). Example 6 indicate that some used the radicals for reading the *kanji* just as their beginner counterparts did.

- 4) If I didn't know the kanji, I had absolutely no idea. I couldn't even guess. I don't know whether there is any particular way you know, or whether a certain part of kanji tells you.
- 5) Sometimes, for the kanji that I didn't know, I just pressed the 'yes' button because they had the same radical but I didn't know whether or not they had the same sound, but I just couldn't help it.
- 6) I did sometimes look at the radical, like when it was 'water' [the water radical], I would say /sui/ [i.e., the reading of the kanji 'water'] was the reading [of the kanji on the screen].

However, there were six remarks that suggest that they were aware of the phonological function of phonetics (see example 7).

- 7) There were some cases where I didn't know the kanji, but many had a component [the phonetic] like koo as part of it. I know that if you've got /koo/ in it, you actually read the whole kanji /koR/. So I took a few educated guesses for some of them.

Judging from the remarks made by the intermediate L2 readers, it seems that phonetic awareness emerges after learning a few hundred *kanji*, unlike radical awareness, which starts to develop at an early stage of *kanji* learning.

At the advanced level, 7 remarks (out of 53 comments on the same-different sound and sound matching tasks) suggest that the advanced readers did utilize the phonological information from phonetics to infer the reading of the *kanji* (see example 8).

- 8) Even if I didn't know the kanji, if I recognized part of the kanji that was with a particular pronunciation, I guessed that the pronunciation of the kanji would be the same.

However, 12 participants in the advanced group made comments suggesting that they read the *kanji* at the character-level without relying on the component information.

Similarly, while four remarks made by the L1 readers (out of 32 comments on same-different sound and sound matching tasks) suggest L1 readers also used the information conveyed by phonetic components when they could not read the *kanji* (see example 9), 15 remarks suggest that L1 readers read the *kanji* at the character-level without relying on the component information.

- 9) Occasionally, I couldn't recall any readings of the character. In those cases I just pressed the 'yes' key if I saw the same phonetic component in the kanji.

4.4 *Development of awareness of the limitations of component information*

As described above, some *beginner* L2 readers were aware that *kanji* sharing a common component sometimes have similar meanings. Nine remarks (out of 77 comments on the four semantic and phonological tasks) further show that a few seem to have noticed that some *kanji* sharing a common component are not related in any way. However, their feeling of wariness could be due to the lack of the component knowledge (see example 1).

- 1) When the radicals are similar, I think they can sometimes have similar meanings, but sometimes they can be different, so I wasn't sure.

For the *intermediate* L2 readers, nine remarks (out of the total of 120 comments on the four semantic and phonological tasks) suggest that some participants were aware of the limitations of the radicals and phonetics (see examples 2 and 3). A few of those appear to have tried other processing strategies such as making compound words containing the target *kanji* to see their semantic or phonological relationship (see example 4).

- 2) I was mainly relying on the radicals when I didn't know the meanings of the characters. I know that sometimes similar radicals can have a similar meaning, but in other cases they don't, so there may be a few mistakes if you use that method all the time.
 3) Sometimes the reading could be the same if the two kanji had the same component, but it's not always the case. If you don't know the reading, it's hard to guess.
 4) I'd think about in what word I'd seen it, and think if the one was related to the other one at all. I'd think about the context of the words because you can't always rely on the radicals.

On the other hand, for the advanced readers, 15 remarks (out of 86 comments on the four semantic and phonological tasks) suggested that they were aware that the functional components (radicals and phonetics) were not always reliable (see examples 5 and 6).

- 5) It was hard to tell whether the characters were in the same category or not. Sometimes if the radical was the same, you would kind of assume that they were in the same category, but sometimes they could have different meanings.
 6) For those ones that I didn't know, I tried to look for a particular component. It normally comes on the right-hand side, but sometimes comes on the left, sometimes at the bottom, and sometimes at the top. But I know, a lot of times, you can't rely on that.

A clear difference between the *advanced* L2 readers and the intermediate L2 readers was that the former had awareness of the validity of individual components, as can be seen in example 7. There were four remarks (including example 7) that indicate that some advanced L2 readers might have been aware of the different degree of component validity.

- 7) It was easy if you saw ones, like doo in doo kutsu [meaning 'cave'], the ones with strong phonetic things like doo nearly always have the same sound. So you can really bank on it. But some are weaker than others, some get changed more.

L1 readers' comments in relation to awareness of the limitations of component information were somewhat different from those made by the L2 readers. Many L1 readers remarked that the inconsistent information from the character and the radical confused them (see example 8).

- 8) It was sometimes confusing, as some kanji did not have any meaning related to the category name but their radical did.

Generally, the L1 readers appear to have processed the *kanji* at the character level without relying on the information from the components. However, remarks such as example 8 suggest that they did process the information from the components. Nevertheless, their judgements were made based on the information from the *kanji* as a whole if it was available.

5 Conclusion

In this article, I investigated L2 readers' developing awareness of the structural and functional properties of sub-character units (components) of *kanji* via their metalinguistic accounts. The data were obtained by asking participants to verbally account for their performance in *kanji* processing tasks. Overall, our interview data suggest that L2 readers gradually develop their awareness in four aspects: positions and combinations, semantic function, phonological function and the limitations of the functions of components. The gradual development in each of these four aspects, however, was not at a uniform pace. Awareness of component positions and combinations, and awareness of the semantic function of radicals appear to develop earlier than the other two aspects.

The interview data have revealed a few points worth noting. Firstly, a sign of rudimentary awareness emerges very early, which could be due to the metacognitive ability developed in the adult readers. Everson and Ke (1997) concluded from the results of their study that intermediate learners take holistic, all-or-nothing approaches to character identification, while advanced learners use more analytical procedures during character processing. However, the findings of the current study suggest that L2 readers are analytical from an early stage of characters learning. Beginner L2 readers may not be able to make use of the awareness in character recognition due to the lack of knowledge of individual functional components. Nevertheless, there was evidence suggesting that rudimentary awareness of components emerges at the beginners' level.

The interview data of the present study suggest that the development of awareness of phonetics evolved much later than that of radicals. Research findings regarding this issue can be found in studies on Chinese children. Although the participants' backgrounds are different, the findings from the following two studies may serve as a useful reference. A study by Ho, Ng and Ng (2003) found that Chinese children came to utilize phonetics prior to main radicals, whereas Shu and Anderson (1998) found that Chinese children became aware of radicals earlier than phonetics. One reason why there might not be a clear preference in the developmental sequence in Chinese could be that radicals and phonetics are equally important and useful, because in Chinese there is a large number of phonetic compound characters (characters consisting of a radical and a phonetic). In Japanese *kanji*, however, the number of phonetic compound characters is much smaller and the phonetics are useful only for the retrieval of on-readings, i.e. one of the two types of readings. This could be a reason for the slow development of phonetic awareness in Japanese. It appears that awareness develops in a particular sequence that is dictated by the orthographic principles.

Another intriguing finding in this study concerns the awareness of the validity of individual components. Koda (1999a; 2002) suggests that what really separates native from non-native performance is the ability to detect component information validity. The data of the present study suggest such awareness begins to develop at the advanced L2 level. Intermediate L2 readers sometimes overgeneralize and overuse the information from the component level when they cannot recognize the *kanji* at the character level. However, at a more advanced level, readers become aware of the functional differences between radicals and phonetics, as well as their validity, and can use this information selectively.

The interview data further suggest that some early-developed awareness may become latent (move to the background). Advanced L2 readers showed a tendency not to rely on the radicals, which was also observed in L1 readers. By this stage, readers can recognize a number of *kanji* based mainly on the information generated at the character level (if the visual stimuli were *kanji*), as frequently appearing *kanji* have formed strong links between orthographic, phonological and semantic information. Therefore, although component level information may still be processed, the information from the characters is prioritized. However, this does not mean that skilled readers are not aware of radicals any more. It means that the radical awareness has become latent, and there-

fore it was not accessed when the readers were asked to bring their awareness to the conscious level.

Implications of the findings for classroom learning and teaching are significant. L2 learners' awareness of component structures and functions are inevitably influenced by classroom instruction. The early rudimentary awareness shown by the participants may be an outcome of analytical introduction of *kanji* characters in the classroom. In many cases, however, after the initial introduction and explanation of components at the beginning, learners are generally left to their own devices in terms of how to learn and store the *kanji* (Shimizu & Green, 2002). Such learning conditions do not provide a good opportunity for learners to understand the structure and function within and between characters. It may be helpful for adjusting the strength of links between characters as well as between characters and their functional components, if each introduction of a new *kanji* were made in relation to already-introduced *kanji* with an emphasis on the common component. Nevertheless, although knowledge of functional components is essential, the reliability of functional components must be considered first, as the radicals and phonetics that appear rarely in *kanji* are of little use. It may be feasible to enhance the speed of further development of radical and phonetic awareness by providing L2 learners with selected useful radicals and phonetics in conjunction with abundant opportunities for using them in reading.

Lastly but importantly, I emphasize that interview data can be a treasure trove for analysis when dealing with metacognitively developed adult readers. Conventionally, awareness has been assessed by inference based on the results of the performance on word recognition tasks. This study however demonstrates that adult L2 readers are aware of word (character) recognition process and that they can, to a certain extent, express their awareness explicitly.

References

- Alderson, J.C. (2000). *Assessing reading*. Cambridge: Cambridge University Press.
- Birdsong, D. (1989). *Metalinguistic performance and interlinguistic competence*. Berlin: Springer-Verlag.
- Brisbois, J.E. (1995). Connections between first- and second-language reading. *Journal of Reading Behavior*, 27(4), 565–584.
- Chikamatsu (2006). Developmental word recognition: A study of L1 English readers of L2 Japanese. *The Modern Language Journal*, 90(1), 67–85.
- Ericsson, K.A., & Simon, H.A. (1984/1993). *Protocol analysis: verbal reports as data*. Cambridge, MA: MIT Press.
- Everson, M.E., & Ke, C. (1997) An inquiry into the reading strategies of intermediate and advanced learners of Chinese as a foreign language. *Journal of the Chinese Language Teacher association*, 32, 1–20.
- Flores d'Arcais, G.B., Saito, H., & Kawakami, M. (1995). Phonological and semantic activation in reading kanji characters. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 21(1), 34–42.
- Gass, S.M. (2001). Innovations in second language research methods. *Annual Review of Applied Linguistics*, 21, 221–232.
- Gottardo, A., Yan, B., Siegel, L.S., & Wade-Wooley, L. (2001). Factors related to English reading performance in children with Chinese as a first language: More evidence of cross-language transfer of phonological processing. *Journal of Educational Psychology*, 93(3), 530–542.
- Herriman, M. (1991). Metalinguistic development. *Australian Journal of Reading*, 14(4), 326–338.
- Hirose, H. (1998). Identifying the On- and Kun-readings of Chinese characters: Identification of On versus Kun as a strategy-based judgment. In C.K. Leong & K. Tamaoka (Eds.), *Cognitive processing of the Chinese and the Japanese languages. Vol. 14* (pp. 221–240). Dordrecht: Kluwer Academic Publishers.
- Ho, C.S.H., Ng, T.-T., & Ng, W.K. (2003). A 'radical' approach to reading development in Chinese: The role of semantic radicals and phonetic radicals. *Journal of Literacy Research* 35(3), 849–878.
- Ho, C.S.H., & Bryant, P. (1997). Learning to read Chinese beyond the logographic phase. *Reading Research Quarterly*, 32(3), 276–289.
- Holm, A., & Dodd, B. (1996). The effect of first written language on the acquisition of English literacy. *Cognition*, 59, 119–14
- Jackson, N.E., Chen, H., Goldsberry, L., Kim, A., & Vanderwerff, C. (1999). Effects of variations in orthographic information on Asian and American readers' English text reading. *Reading and Writing – An Interdisciplinary Journal*, 11, 345–379.

- Jackson, N.E., Lu, W.-H., & Ju, D. (1994). Reading Chinese and reading English: Similarities, differences, and second-language reading. In V.W. Berninger (Ed.), *The varieties of orthographic knowledge - theoretical and developmental issues. Vol. 1* (pp. 73–110). Dordrecht: Kluwer Academic Publisher.
- Ke, C. (1998). Effects of language background on the learning of Chinese characters among foreign language students. *Foreign Language Annals*, 31(1), 91–100.
- Koda, K. (1999a). Development of L2 intraword orthographic sensitivity and decoding skills. *The Modern Language Journal*, 83(1), 51–64.
- Koda, K. (1999b). *Role of intraword awareness in kanji knowledge development*. Paper presented at the AILA World Congress 1999, Tokyo, Japan.
- Koda, K. (2002). Writing systems and learning to read in a second language. In W. Li, J.S. Gaffney & J.L. Packard (Eds.), *Chinese children's reading acquisition* (pp. 225–248). Boston: Kluwer Academic Publishers.
- Martin, S. E. (1972). Nonalphabetic writing systems: some observations. In J.F. Kavanagh & I.G. Mattingly (Eds.), *Language by ear and by eye: The relationships between speech and reading* (pp. 81–102). London: The MIT Press.
- Nation, P. (1993). Using dictionaries to estimate vocabulary size: Essential, but rarely followed procedures. *Language Testing*, 10, 27–40.
- Nomura, M. (1984). Kanji no tokusei wo hakaru [Measuring characteristics of kanji]. In H. Kaiho (Ed.), *Kanji wo kagaku suru [Sciencing kanji]* (pp. 1–33). Tokyo: Yuhikaku.
- Perfetti, C.A. (2003). The universal grammar of reading. *Scientific Studies of Reading*, 7(1), 3–24.
- Pressley, M., & Afflerback, P. (1995). *Verbal protocols of reading: The nature of constructively responsive reading*. New Jersey: Lawrence Erlbaum Associates.
- Read, J. (1993). The development of a new measure of L2 vocabulary knowledge. *Language Testing*, 10(3), 356–371.
- Read, J. (2000). *Assessing vocabulary*. Cambridge: Cambridge University Press.
- Shimizu, H., & Green, K.E. (2002). Japanese language educators' strategies for and attitudes toward teaching kanji. *The Modern Language Journal*, 86(2), 227–241.
- Shu, H., & Anderson, R.C. (1997). Role of radical awareness in the character and word acquisition of Chinese children. *Reading Research Quarterly*, 32(1), 78–89.
- Shu, H., & Anderson, R. C. (1998). Learning to read Chinese: The development of metalinguistic awareness. In J. Wang, A. Inhoff & H.-C Chen (Eds.), *Reading Chinese script: A cognitive analysis* (pp. 1–18). Mahwah, N.J.: Lawrence Erlbaum Association.
- Shu, H., Anderson, R.C., & Wu, N. (2000). Phonetic awareness: Knowledge of orthography-phonology relationship in the character acquisition of Chinese children. *Journal of Educational Psychology*, 92(1), 56–62.
- Stanovich, K. E. (1991). Changing models of reading and reading acquisition. In L. Rieben & C.A. Perfetti (Eds.), *Learning to Read: Basic Research and Its Implications* (pp. 19–31). Hillsdale: Lawrence Erlbaum Associates.
- Tamaoka, K., Kirsner, K., Yanase, Y., Miyaoka, Y., & Kawakami, M. (2002). A web-accessible database of characteristics of the 1945 basic Japanese kanji. *Behavior Research Methods, Instruments and Computers*, 34(2), 260–275.
- Vellutino, F.R. (1991). Introduction to three studies on reading acquisition. *Journal of Educational Psychology*, 83(4), 437–443.

Appendix

ID	Categ.	Prof. Lang.	Other Lang.	ID	Categ.	Prof. Lang.	Other Lang.
B1	Beg	English	Thai	I1	Int	English	French, German
B2	Beg	English	No	I2	Int	English	No
B3	Beg	English	No	I3	Int	English	No
B4	Beg	English	Vietnamese	I4	Int	English	No
B5	Beg	English	No	I5	Int	English	No
B6	Beg	English	Italian	I6	Int	English	No
B7	Beg	English	No	I7	Int	English	No
B8	Beg	English	No	I8	Int	English	French
B9	Beg	English	No	I9	Int	English	No
B10	Beg	English	Hebrew, French	I10	Int	English	No
B11	Beg	English	French	I11	Int	English	German
B12	Beg	English	No	I12	Int	English	No
B13	Beg	English	No	I13	Int	English	No
B14	Beg	English		I14	Int	English	German
B15	Beg	English	No	I15	Int	English	No
B16	Beg	English	German	I 6	Int	English	No
B17	Beg	English	No	I17	Int	English	Filipino, Italian
B18	Beg	English	Indonesian	I18	Int	English	Vietnamese
B19	Beg	English	No	I19	Int	English	No
B20	Beg	English	Spanish	I20	Int	English	German
B21	Beg	English	French, Vietnamese	I21	Int	English	No
B22	Beg	English	French	I22	Int	English	No
B23	Beg	English	Thai	I23	Int	English	No
B24	Beg	English	No	I24	Int	English	No
B25	Beg	English	German	I25	Int	English	French, Chinese
B26	Beg	English	Maltese	I26	Int	English	Italian
B27	Beg	English	Arabic	I27	Int	English	Hebrew
B28	Beg	English	French, Filipino	I28	Int	English	No
B29	Beg	English	No	I29	Int	English	French, Italian
B30	Beg	English	No	I30	Int	English	French, Italian
B31	Beg	English	No	I31	Int	English	No
B32	Beg	English	German, Greek	I32	Int	English	No
B33	Beg	English	Spanish	I33	Int	English	No
B34	Beg	English	No	I34	Int	English	No
B35	Beg	English	Italian, German	I35	Int	English	Italian, Spanish
B36	Beg	English	Filipino	I36	Int	English	Thai
B37	Beg	English	Indonesian	I37	Int	English	No
B38	Beg	English	No				
B39	Beg	English	No				

ID	Categ.	Prof. Lang.	Other Lang.	ID	Categ.	Prof. Lang.	Other Lang.
A1	Adv	English	Chinese	N1	Native	Japanese	English
A2	Adv	English	Chinese, French	N2	Native	Japanese	English
A3	Adv	English	Spanish, German	N3	Native	Japanese	English, Danish
A4	Adv	English	No	N4	Native	Japanese	English, German
A5	Adv	English	Italian	N5	Native	Japanese	English, Spanish
A6	Adv	English	No	N6	Native	Japanese	English
A7	Adv	English	German, French	N7	Native	Japanese	English, Thai
A8	Adv	English	German	N8	Native	Japanese	English
A9	Adv	English	German, Italian, French	N9	Native	Japanese	English
A10	Adv	English	Hebrew	N10	Native	Japanese	English
A11	Adv	English	No	N11	Native	Japanese	English, Thai
A12	Adv	English	Spanish	N12	Native	Japanese	English
A13	Adv	English	No	N13	Native	Japanese	English, French
A14	Adv	English	No	N14	Native	Japanese	English
A15	Adv	English	No	N15	Native	Japanese	English
A16	Adv	English	Spanish, German	N16	Native	Japanese	English
A17	Adv	English	French				
A18	Adv	English	French, African				
A19	Adv	English	No				
A20	Adv	English	No				
A21	Adv	English	French				
A22	Adv	English	No				
A23	Adv	English	French				
A24	Adv	English	German				
A25	Adv	English	No				
A26	Adv	English	No				
A27	Adv	English	French				