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# ENHANCING AUTONOMOUS L2 VOCABULARY LEARNING FOCUSING ON THE DEVELOPMENT OF WORD-LEVEL PROCESSING SKILLS

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## Abstract

The paper reviewed studies in word-level processing skills and related areas, and profiled how the development of L2 word recognition and integration skills would contribute to autonomous *kango* (Chinese originated words or words created from Chinese originated words) vocabulary learning. Despite the fact that the acquisition of a significant number of *kango* (which takes up a large portion of Japanese vocabulary) is critical for effective reading comprehension, acquiring *kango* is often hindered, particularly for learners with an alphabetic background, by the unfamiliar script, complex features of constituent characters, non-transparent word construction and non-apparent word usage. The paper argued that explicit instruction on the use of intra-word clues such as the structure and functions of words and their smaller functional units, and complement clues such as syntactic and semantic information would be able to overcome the difficulties. The paper further made recommendations on the use of websites and online dictionaries targeting English-speaking learners for enhancing their autonomous vocabulary learning.

## Why is it important to learn *kango* (multi-*kanji* words) to improve reading in Japanese?

Strong relationships between reading and vocabulary knowledge have been found in both L1 and L2 studies, with a very high correlation found between word-level processing skills and vocabulary knowledge (Grabe, 2004; Carver, 2003; Fender, 2001; Haynes and Carr, 1990; Koda, 1989). There is no doubt that reading ability improves with extensive exposure to texts. However, without a large size of sight vocabulary, reading comprehension would be impaired (Carver and David, 2001). Research in this essential element for improving reading ability, vocabulary learning, has a long history. While previous studies focused on vocabulary memorization and retention (see Meara, 1980), more recent studies question the effectiveness of memory strategies for a long-term vocabulary learning from the perspective of the formation of word recognition and integration skills (e.g., Fender, 2001; Gu and Johnson, 1996). Gu and Johnson (1996) claim,

> In addition to remembering the form-meaning association, learning the skill of recognizing a word automatically in natural contexts, the skill of guessing what a word means, and most importantly, the skill of using a word correctly and appropriately should be the purpose of vocabulary learning (p.660).

Particularly in L2 contexts, Koda (1989) found that vocabulary knowledge was the single most

significant factor differentiating learners with a related L1 orthographic background from those with an unrelated L1 orthographic background, and the difference magnified over time, which affected the overall development of their L2 reading performance. In the light of these findings, Koda emphasizes the importance of explicit vocabulary instruction focusing on the development of L2 specific word-level processing skills by taking L1 and L2 orthographic differences into consideration.

When learning to read in an L2, learners are required to become aware of the features of the new script in order to learn the L2 vocabulary efficiently (Koda, 1999). Particularly when L2 orthography is very different from that of L1, it is critical to develop skills to recognize and integrate words using the L2 script-specific features as clues, as word recognition and integration skills are two potential sources of lower-level processing difficulty among L2 learners (Fender, 2001). The development of these word-level processing skills before L2 learners start to encounter a large number of unfamiliar words in reading authentic printed materials is essential in order to enable L2 learners to learn vocabulary on their own (Kang and Golden, 1994). However, studies indicate that explicit vocabulary teaching in L2 language instruction is far from sufficient, and vocabulary instruction in Japanese as a second language is no exception (Mori and Nagy, 1999; Kang and Golden, 1994). Although a shift from the conventional whole-word approach to the componential approach has taken place, the focus is still on memorization and retention. A systematic approach for the development of word recognition and integration skills is called for.

Japanese vocabulary can be broadly classified into *kango* (Chinese originated words or words created from Chinese originated words), *wago* (native Japanese words) and *gairaigo* (loanwords). It is said that about 70% of Japanese dictionary entries are two-*kanji* words (Shimomura and Yokosawa, 1991), the majority of which are *kango* (Mori and Nagy, 1999; Tomita and Sanada, 1994). *Kanji* is characters used in the Japanese writing system, most of which originated in Chinese *hanzi* characters. The percentage of multi-kanji words becomes bigger if including words consisting of more than two *kanji*. This is because a large number of multi-*kanji* compound words were created in Japan during the 17-19th centuries in order to translate the flood of new western concepts into Japanese (Takashima, 2001). *Kango* is composed of more than one *kanji* character, each of which is read in the *on*-reading, a system of reading *kanji* in a way that at one stage approximated the original Chinese (Kitahara, 2003).

*Kango* are essential for building Cognitive Academic Language Proficiency - CALP (the term introduced by Cummins, 1981). In formal settings whether spoken or written, learners of Japanese are required to have good knowledge of *kango*, as most content words used in the formal situations would be *kango* (Shimomura and Yokosawa, 1991). For learners of Japanese who have mastered Basic Interpersonal Comunication Skills - BICS, building the knowledge of *kango* is crucial for their further study. However, anecdotal evidence suggests that even learners with experience of many years of Japanese study often fail to comprehend written texts of an advanced level with full of *kango*, and this is particularly apparent among those with an alphabetic background.

One might argue that learners could use context information to complement their lack of vocabulary. In fact, there is evidence suggesting L2 learners of Japanese with an alphabetic background read Japanese texts by making use of context information (Machida, 2001). However, abundant research suggests that the reliance on context often results in inadequate comprehension (e.g., Perfetti, 1991; Cunningham, Stanovich and Wilson, 1990; Stanovich, 1980). Readers are therefore required to have a wide vocabulary for successful reading comprehension. In the case of Japanese, learners, intermediate and advanced learners in particular, need to acquire a large number of *kango*, which cover most of the content words in formal texts.

Learning *kango* is however not a simple task particularly for learners from an alphabetic background. One of the reasons for the difficulty of learning *kango* may be that learners do not have skills to make use of clues at the word-level that are helpful for learning the words. Learners who can process the intra-word features of *kango* accurately are likely to recognize words and link them to previously learned words, and the repeated successful recognition would reinforce the inputs, which would naturally help retaining the words in the memory. Moreover, being able to integrate intra-word information and (immediate) context information may be critical for learning reading comprehension.

In this paper, I would like to firstly examine why *kango* are hard to learn for learners from alphabetic script, and based on previous research findings, discuss what measures can be taken to overcome the difficulties. I would also like to make some suggestions for vocabulary learning/ teaching using websites and online dictionaries targeting English-speaking learners.

**Why is learning *kango* not easy?**

1) *Kango* written in unfamiliar script

In order to learn *kango*, one has to learn individual *kanji* characters that are the constituent elements. This may be difficult for learners who have never been exposed to script that is not phonetically transparent. Children learning to read gradually develop word reading ability that is shaped by the features of the script (Miller, 2002; Koda, 1997). If the L1 were an alphabetic script, children would probably learn how to segment a word into constituent letters and map the letters with sounds (see Perfetti, Van Dyke and Hart, 2001; Adams, 1990 for reviews). When encountering a *kango* in a L2 setting, learners who have acquired the reading ability suited an alphabetic script would probably be bewildered without knowing how to deal with the words written in the non-alphabetic script.

Mori (1998) conducted an interesting experiment investigating the transfer of word reading skills from L1 to L2, using non-*kanji* with and without artificial pronunciation markers (Japanese syllabic *katakana*) embedded within them. An alphabetic group (Americans) and two non-alphabetic groups (Chinese and Koreans with experience with characters) were tested on their ability to retain new non-*kanji* in their short-term memory. The participants were asked to identify the target non-*kanji* after studying a list of non-*kanji* with or without the artificial pronunciation markers (*katakana*). The alphabetic group found that phonologically accessible non-*kanji* (containing *katakana*) were easier to remember than the phonologically inaccessible non-*kanji* (without *katakana*). Conversely, the non-alphabetic group showed virtually no difference in recognizing the two different types of non-*kanji*. This study suggests that the reliance on phonological information is stronger in alphabetic readers than in non-alphabetic readers.

If *kanji* characters always have clear phonological information as in the case of the pronunciation-marker-embedded artificial characters in Mori's study, L2 learners of Japanese with an alphabetic background may be able to learn vocabulary without much difficulty through their primary phonological processing. However, the reality is that *kanji* characters are in most cases not phonologically transparent. For L2 learners of Japanese with an alphabetic background, the familiar phonological processing is not always readily applicable. This inaccessibility of phonological information may hinder L2 learners to successfully learn *kango*. As a consequence, alphabetic readers may be left with words in unfamiliar non-alphabetic script without knowing how to process them appropriately.

2) Ambiguous features of *kanji* characters

At an initial stage of learning Japanese, learners are usually exposed to high-frequency words, which usually contain high-frequency *kanji* characters. This frequency-ordered method has a good ground for it. The high-frequency words are naturally the words that learners often encounter, and therefore need to be taught first. However, the downside of this is that learners may easily hold misconceptions about Japanese *kanji* characters/words. The misconceptions include:

2-1) There are many *kanji* that look similar and hard to distinguish.

Because the focus of teaching high-frequency words is, in most cases, on the meanings (translations) of the words, detailed instruction on the features of *kanji* is often neglected, mainly due to a limited teaching time. Learners are often left to their own devices in learning individual *kanji* characters. Novice learners may learn *kanji* characters as a cluster of small strokes without recognizing recurrent patterns. Research suggests that children learning to read in alphabetic script at first recognize script as a whole (Harris and Coltheart, 1986; Gough, 1991), and novice readers of characters are no exception (Ho and Bryant, 1997). L2 learners at an initial stage of learning to read *kanji* may not be able to segment a character into meaningful units. Research indeed suggests that beginner L2 learners segment characters into the units of a combination of random strokes rather than the units of radicals (Wang. Liu and Perfetti, 2004; Hatta, Kawakami and Tamaoka, 1998).

2-2) A *kanji* has numerous readings.

Typical textbooks for learners of Japanese as a second language introduce high frequency words without considering the irregularity of readings of the *kanji* characters used in those words. Novice L2 learners are often required to memorize introduced words without knowing the phonetic system of the script. They would naturally encounter several words with a common *kanji* character that are often read differently. For example, the readings of the words, 動物 'animal' and 買物 'shopping', are /doubutsu/ and /kaimono/, where no common reading is found among them despite the common *kanji*. Novice learners may have a wrong impression that the reading of *kanji* characters is totally arbitrary.

2-3) Many *kanji* represent the same reading

At the same time as learners see the same *kanji* being read differently, they would probably find a variety of *kanji* being used to represent the same sound, as can be seen in the sound /kou/ in 公園 /kouen/ 'park', 交通 /koutsuu/ 'traffic' and 高校 /koukou/ 'high school'. Numerous homophones were the results of smaller number of phonetics in Japanese as to Chinese (Tamaoka. 1991). Without having such historical knowledge, learners may think that homophonic *kanji* are interchangeable. Anecdotal evidence suggests that learners from an alphabetic background often use a wrong *kanji* (for example, 公通 /koutsuu/ instead of correct 交通 /koutsuu/) that is a homophone of the correct *kanji* without taking the meaning into consideration.

2-4) A *kanji* has many meanings.

By the same token, L2 learners may hold a wrong assumption that the same *kanji* character appearing in several words has a number of different meanings. As described above, words are often introduced to learners without breaking up the words into the constituent *kanji* characters, and novice learners most likely study the words with the mediation of English translations. For example, when the learner learn the words, 学生 /gakusei/ 'student', 誕生日 /tanjoubi/ 'birthday' and 生活 /seikatsu/ 'life, living' on separate occasions, they may not be able to see the links between the words through the common *kanj*i, 生, and may fail to grasp a general concept of it.

3) Non-transparent construction of *kango*

*Kango* consist of *kanji* characters. If the learner held the belief that there is no system in *kanji* learning, learning *kango* would definitely be a challenge. To make the matter worse, learners are

often not well informed about how a word is constructed when being presented with *kango*. Just as the English word, 'birthday' consists of 'birth' and 'day', the Japanese version, '誕生日 /tanjoubi/' consists of 誕 'birth', 生 'live/life' and 日 'day'. Without explicit instruction, learners may not realize the semantic contribution of the constituent *kanji* characters in *kango*.

4) Little knowledge on the usage of *kango*

Often *kango* are presented to learners in a list together with their translations without detailing on how they should be used in a sentence. Learners would naturally attempt to use the learned words as they use the translated version of the words. However, the presented words and their translated version may be used differently in terms of part of speech. For example, although the English translations of 本当 /hontou/ 'real' and 有名 /yuumei/ 'famous' are both adjectives, they are a noun and an adjective in Japanese. Moreover, learners cannot learn from such list how the presented *kango* differs from its *wago* equivalent. In most cases, learners learn *wago* (Japanese native words) prior to learning kango. For example, The *wago* equivalent of the *kango* 洗濯する /sentaku suru/ 'to do washing' is 洗う /arau/ 'to wash'. Learners may use 洗濯する wherever 洗う /arau/ would be used, where in fact 洗濯する /sentaku suru/ can only be used for cloth washing.

**What can be done to make the learning of *kango* easier?**

Vocabulary learning in Japanese may not be easy, as the unfamiliar script, complex features of constituent characters, non-transparent word construction and non-apparent usage of *kango* place burdens on L2 learners of Japanese, particularly on those with an alphabetic background. In this section, I would like to look into how the difficulty in vocabulary learning may be mitigated by training L2 learners in the following areas: 1) familiarizing with the non-alphabetic script, 2) identifying the semantic indicator in the constituent characters of a word, 3) making use of morphemic and phonetic clues, 4) making use of the information conveyed by constituent *kanji* characters, and 5) analyzing syntactic and semantic information outside of the words. Explicit instruction in these areas may possibly enhance L2 learners' autonomous vocabulary learning.

1) Familiarizing with the non-alphabetic script.

Research suggests that L1 readers become gradually aware of the language features of their native language (Slobin and Bever, 1982). Numerous studies indicate that L2 learners utilize cognitive skills developed in their L1 when learning words in L2 (McDonough, 1995; Hatta, Hatae and Kirsner, 1984). In learning *kango* in Japanese, learners with an alphabetic background are likely to try to learn words phonologically by assigning each constituent *kanji* character a sound. Soon they would realize that the same *kanji* is read differently in different words, and may draw a false conclusion that each word needs to be learned as a completely separate entity. Under these circumstances, L2 learners of Japanese would probably feel the sheer immensity of the task of learning hundreds and thousands of words.

In order to reduce the stress, learners need to be well equipped before venturing into the study of *kango*. It is important, first of all, to give learners an overview of the Japanese writing system. The impact of such orientation on Japanese vocabulary learning should not be underestimated. The website 'Online Japanese Writing System' - http://www.kanji.org/kanji/japanese/writing/outline.htm - provides learners with a wide range of essential information. 'Wikipedia' explains the background and the significance of *kango* in the Japanese writing system - http://en.wikipedia.org/wiki/Sino-Japanese. By providing learners with the overview of the Japanese vocabulary, they would know what they have to learn ahead.

L2 learners of Japanese also need to be informed that *kango* consist of a certain number of characters and the characters consist of a limited number of smaller units called radicals. Although an enormous number of *kanji* characters exist (the largest *kanji* dictionary in Japan comprises 50,000 characters), the amount of characters for daily use is restricted to 1,945 by the Japanese government (Taylor, 1997; Tomita and Sanada, 1994). Within the 1,945, 1,000 most frequently used *kanji* occupy approximately 90% of Japanese *kanji*-written words (Nomura, 1984).

Characters can be grouped, roughly speaking, 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). The non-separable *kanji* can often be radicals of other types of *kanji* by altering the shape and size slightly (Shu, Chen, Anderson, Wu and Xuan, 2003), as can be seen in the above example *kanji*. Apart from these non-separable *kanji*, there are other recurrent stroke patterns appearing as a radical in *kanji*. Together with the non-separable *kanji* used as a radical, the number of radicals sums up to 214 (Tomita and Sanada, 1994). The website ‘About: Japanese Language’ has a section for radicals - http://japanese.about.com/library/weekly/aa070101a.htm. For a full list of radicals, learners should be referred to the site, 'Radical index' - http://www.*kanji*dict.com/demo/radicals.html. The origins of the radicals can be viewed in animation in the ‘Bushu no naritachi’ section of the 'Gakushuu Anime no Yakata’ - http://meiko.web.infoseek.co.jp/. Awareness of the forms of characters and radicals is fundamental to the orthographic processing of characters (Wang, Perfetti and Liu, 2003). It is recommended that L2 learners have such awareness prior to the study of individual *kanji* and *kango*. It is critical that L2 learners be familiarized with the basic patterns of characters and the shapes of these radicals, as the proper segmentation would assist organized storage and activation (for recognition and reproduction) of characters (Toyoda, 2006), which are the constituent elements of *kango*.

2) Identifying the semantic indicator in the constituent characters of a word

Some of the radicals of a character can act as a semantic or a phonetic indicator in a *kanji* character. A semantic indicator, which is referred to as a 'main radical' in this paper, is the radical designated as a dictionary index. Each *kanji* has one main radical, and is classified under it in a character dictionary (Koda, 2002). Abundant research demonstrates important roles that main radicals play in learning to read characters (e.g., Ho, Ng and Ng, 2003: Shu and Anderson, 1997; Chen, Allport and Marshall, 1996). It has been claimed that skilled readers process the main radicals differently from other radicals (e.g., Chen and Allport, 1995; Leck, Weekes, and Chen, 1995).

In order to utilize the main radicals in vocabulary learning, learners need to be able to identify them in a character (Shu, Chen, Anderson, Wu and Xuan, 2003). Every time a kanji is introduced to L2 learners, its main radical should be brought to attention with an emphasis on its location. Taft and Zhu (1997a) hypothesize that when skilled readers see a character, the component units are activated, and in addition to the information of component features, component position information is spread. Indeed position awareness is one of the fundamental awareness required for character orthographic processing (Wang, Perfetti and Liu, 2003). Taft and Zhu (1997a), calculating from the Chinese Radical Position Frequency Dictionary, demonstrated that about 66% of all main radicals have fixed positions within characters: left, right, top, bottom or in the middle. There are a few main radicals that do not have fixed positions. For example, the main radical 日 can appear in various positions: left, 暗, right, 旧, top, 景, and bottom, 旨. However, in most cases main radicals have a preferred position over the other positions even if it is not fixed. For example, the main radical 言 usually appears in the left-hand side of the character with a few exceptional cases (e.g., 警). It is reported that about 80-90% of the left-right pattern characters have their main radical on the left-

hand side (Taft and Zhu, 1997a).

Although L2 learners of characters become able to detect illegal radicals and/or illegally positioned radicals even without explicit instruction (e.g., Wang, Perfetti, and Liu, 2003), identifying the main radical among legally positioned radicals is much harder let alone identifying legal radicals in general. Wang, Liu and Perfetti (2004) reported that, when novice learners of Chinese with an alphabetic background were asked to utilize part of a character to guess the meaning of an unfamiliar character, they often identified 'certain stroke combinations' that are only parts of radicals, which resulted in errors. Finding the main radical is crucial when encountering an unfamiliar *kango*. If the reading of the word is unknown, what a learner would usually do is to look up the constituent *kanji* in a *kanji* dictionary and try to find the target word in a provided list of *kango* containing the *kanji*. Although a few learner-friendly on-line dictionaries – for example, 'WWWJDIC' - http://www.csse.monash.edu.au/~jwb/cgi-bin/wwwjdic.cgi?1R- allow learners to find the target *kanji* by ticking boxes of any radicals contained in the *kanji*, most *kanji* dictionaries still require learners to search the *kanji* from its main radical (if not from the reading or the stroke number). Being able to identify the main radical of the *kanji* enables learners to look up the *kanji* in a dictionary efficiently. 'Kiki's Kanji Dictionary' - http://www.nuthatch.com/kanji/demo/frame.html - can be a good practice for looking up kanji from their main radicals. This site also shows a list of words containing the target *kanji*.

The identification of the main radical of a *kanji* also assists the learner in locating a phonetic indicator, a 'phonetic'. Unlike the main radical, a phonetic can be found only in some *kanji* characters. However, when there is a phonetic, it is in most cases on the other side of the main radical (Flores d'Arcaise, 1992; Huang and Hanley, 1995; Wang, 1981). For example, the character 語 /go/ 'word' has the main radical on its left showing a broad meaning category 'speech' and the phonetic on its right showing a broad sound category /go/. In this regard, knowing the positions of main radicals is essential, not only for accessing the semantic information of the main radicals, but also for finding phonetics and retrieving their phonological information (this will be further discussed in the following section).

Initially, the segmentation of a character might begin with a small unit that might in effect be a 'familiar shape'. Progress in processing would facilitate the change of this unit into a 'radical'. The unit would eventually be a radical or a set of radicals that carry semantic or phonological information, namely a main radical or a phonetic. Only then would it be a 'functional component'. When a 'component' becomes a functional component, learners will be able to learn *kango* autonomously. Learners will become able to learn a new *kango* as a cluster of smaller functional units - characters and functional components (main radicals and phonetics), which can be building blocks for other *kango.*

3) Making use of morphemic and phonetic clues

When L2 learners have come to the stage where they encounter many compound *kanji* (consisting of more than one radical), they may need to be familiarized with main radicals and phonetics. Main radicals, with a few exceptions, carry semantic information indicating a broad meaning field that the *kanji* character belongs. This point needs to be made clearly; a main radical shows a broad meaning category, rather than a meaning. Moreover, semantic relationships between a character and its main radical and between the characters sharing the same main radical are sometimes not always transparent (Shu, Chen, Anderson, Wu and Xuan, 2003; Flores d'Arcais, Saito and Kawasaki, 1995). Nevertheless, at least some main radicals can give fairly reliable morphemic clues. Shu and Anderson (1997) reported that Chinese children use the semantic

information conveyed by the main radicals as assistance in learning new characters. In the case of Japanese, when encountering a *kango*, L2 learners may attempt to figure out the meaning of the word by inferring the meanings of the constituent characters. The main radicals of the characters can be clues for inferring their meanings in terms of giving semantic boundaries to the character. Even if learners do not know what semantic category the main radical indicates, it can still be useful, as they may be able to infer the meaning field of a character by referring to the meanings of the other characters that share the main radical. Moreover, being able to use the semantic information of main radicals is essential in identifying a *kango* with the correct *kanji* when there are a few other homophones.

Explicit instruction on main radicals and their semantic categories appears to be critical for efficient *kanji* vocabulary learning. Learners may be able to acquire the semantic information of main radicals implicitly over time. However, research suggests that explicit instruction can enhance the learning of characters (Wang, Liu and Perfetti, 2004; Nagy, Kuo-Kealoha, Wu, Li, Anderson and Chen, 2002; Taft and Chung, 1999). For example, Wang, Liu and Perfetti (2004) asked English- or German- speaking beginner learners of Chinese to infer the meanings of unknown characters with no probing. The results showed that the participants made an attempt to infer the meanings on a very small percentage of the unknown characters but were not successful. However, after given explanations of the semantic relation between characters and their main radicals, these learners' performance improved significantly. The explicit instruction helped them in identifying the main radicals from which they inferred the meanings of the unknown characters.

A phonetic indicates a sound group (a group of similar sounds), which may suggest a reading of the character or a sound similar to it. It should be made clear to learners that a phonetic is not identical to 'a radical carrying phonological information' as it can consist of more than one radical. The character 湖, for example, has a phonetic 胡 /ko/ that is composed of two radicals, 古 and 月. There is no consensus on the number of phonetics. However, it is estimated that 800-1100 phonetics exist in Chinese *hanzi* (Shu, 2003; Hoosain, 1991) and approximately 700 exist in Japanese *kanji* (Koda, 2002). Some of them are single radicals (e.g., 工 /kou/ in 功, 項, 巧, 紅, 貢), and some are composed of more than one radical (e.g., 利 /ri/ in 痢, 梨, 俐, 犁, 悧 - the last four characters are not one of the 1,945 general-use *kanji*).

Phonetics can only be found in a particular type of character called ‘phonetic-ideographic *kanji*’ (Hoosain, 1991), which composed of a main radical and a phonetic. The majority of characters are included in this type (Tomita and Sanada, 1994). It has been reported that 80-90% of modern Chinese characters (Shu, Chen, Anderson, Wu and Xuan, 2003) and 66.1% of the 1,945 *kanji* are categorized as phonetic-ideographic *kanji* (Tamaoka, 1991). Apart from the phonetic-ideographic type, according to the ‘Rikusho’ categorization system that indicates the origins of characters, there are ‘pictograph’ (derived from shapes of objects) and ‘simple ideograph’ (expressing ideas and views) that usually have non-separable graphic pattern, and ‘compound ideograph’, which are a combination of the former (Tomita and Sanada. 1994). However, the number of these types of characters is not large. The '*kanji*graphy' site briefly explains the ‘rikusho’ system - http://www.*kanji*graphy.com/mainpages/info/history.html.

Despite the relatively high proportion of phonetic-ideographic *kanji*, due to various reasons such as the difference between the Chinese and Japanese phonetic systems and different readings at the time of introduction (Tamaoka, 1991), occasions where a phonetic represents the exact reading of the whole *kanji* are rare. In Japanese, unlike Chinese, *kanji* often have more than one reading, attributed to the historical fact that Chinese characters and concepts were brought into Japanese native words. The reading could be one of, or a mixture of, two types of readings: *kun*-reading and

*on*-reading. *Kun*-readings represent morphemes of Japanese origin whereas *on*-readings represent morphemes of Chinese origin (Taylor, 1998; Paradis, Hagiwara and Hildebrandt, 1985). Although 726 of the 1,945 characters (37.3%) do have one-to-one correspondence with reading (32 characters have only one *kun*-reading and 694 characters have only one *on*-reading), the rest have two or more readings (Kaiho and Nomura, 1983). About 60% of the 1,945 characters have both *on*- and *kun*-readings, 38% have multiple *on*-readings (different pronunciations were borrowed from China at different times) and no *kun*-reading, and 2% have multiple *kun*-readings (the same character was used to represent a number of related but different concepts) and no *on*-reading (Tamaoka, 2003). A phonetic can only indicate (one of) the on-reading(s) (Paradis, Hagiwara and Hildebrandt, 1985).

Also, similar to the case in a main radical, it should be noted that a phonetic shows only a broad sound category to which the *kanji* belongs, rather than the exact reading of the character. In *hanzi*, it has been claimed that of all the phonetics in Chinese, 36% give the reading of a character, 48% give partial information, and 16% give no useful information (Yin, 1991 cited in Shu and Anderson, 1998). In *kanji*, it is estimated that the phonological consistency between the sounds of the *kanji* and its phonetic range from 37 to 42% (Koda, 1999).

Despite all the limitations described above, native speakers of Japanese access phonetics for the purpose of recognising single-*kanji* words, i.e., characters (Morita and Matsuda, 2000; Flores d'Arcais, 1992). Studies suggest that phonological information of phonetics of characters becomes available to skilled readers at a very early stage of character recognition, and that this information may even mediate a link between the character and pronunciation (Koda, 2002; Geva and Wang, 2001; Flores d'Arcais, Saito, and Kawakami, 1995).

As aforementioned, not all the main radicals and phonetics are equally important. Research suggests that skilled readers of Japanese utilize, not all the existing functional components, but only 'reliable' ones (Toyoda, 2006). When providing explicit instruction on the main radicals, frequency, transparency and consistency need to be considered. According to Tamaoka, Kirner, Yanase, Miyaoka and Kawakami (2002), among the main radicals, the 10 most frequently used main radicals appear in 34% of the 1,945 Japanese general-use *kanji*, and the 24 of them appear in 54%. For example, the main radical representing 'water' is shared by 103 characters. Although it is apparent that these high frequency main radicals should be taught at an early stage, transparency and consistency also need to be considered concurrently. Within the same semantic domain, the strength of the relationship between characters varies widely (Flores d'Arcais, Saito and Kawasaki, 1995). Some are very closely related. For example, 海 'ocean' and 湖 'lake' share a common main radical 'something related to water', and are semantically closely related, as the two characters are both semantically transparent (i.e., the semantic relationship between the character and its main radical is strong). On the other hand, 海 'ocean' and 決 'decide', for example, are hard to relate to each other, despite their common main radical, as the character 決 'decide' is semantically opaque (i.e., the semantic relationship between the character and its main radical is weak). Clearly, transparency facilitates vocabulary learning (Shu, Anderson and Zhang, 1995). When there are a high percentage of semantically transparent characters exist in the same domain, it is considered to be consistent. For example, the majority of kanji with the ‘speech’ radical, such as 語 ‘word’ and 話 ‘to speak’, and the ones with the ‘hand’ radical, such as 持 ‘to hold’ and 打 ‘ to hit’ are semantically transparent, and therefore these main radicals are considered to be consistent (Damen, 2006). Likewise, for phonetics, regularity and consistency seem to be significant factors influencing skilled reading (Masuda and Saito, 1999) as well as frequency (Taft and Zhu, 1997a). These variables need to be considered when providing explicit instruction (Toyoda, 2006).

In general, it seems to be safe to conclude the following: The main radicals and phonetics that

appear rarely in *kanji* are of little use. If the semantic information conveyed by a main radical has no, or weak, relationship with the meaning of a *kanji*, or if the *kanji* that share a main radical have considerably different meanings, readers would probably not use that main radical in learning *kanji*. Likewise, if the phonological information conveyed by a phonetic does not give a clue to the pronunciation of a *kanji*, or if the *kanji* that share a common phonetic have varied pronunciations, readers would not utilise the phonetic. Becoming aware of frequency, transparency/regularity and consistency would enable L2 learners to selectively use the information generated from main radicals and phonetics.

Research emphasizes that knowledge of main radicals and phonetics serve as a fundamental element of overall *kanji* knowledge (Tamaoka and Yamada, 2000; Leong and Tamaoka, 1995; Flores d'Arcais, Saito and Kawakami, 1995). According to the Path Model presented by Tamaoka and Yamada (2000), knowledge of the functional components (main radicals and phonetics) seems to be an important contributor to knowledge of *kanji* lexical orthography, phonology and semantics. In the light of such research, there is a growing shift from rote memory to componential analysis in *kanji* vocabulary instruction for L2 learners (Toyoda, 1998; Noguchi, 1995). The author of 'Kanji Clinic' (a column appearing the third Tuesday of every other month in an English newspaper published in Japan, *The Japan Times*) - http://www.kanjiclinic.com/preart.htm - advocates the effectiveness of the componential approach. Indeed, evidence demonstrates that learners retain new *kanji* characters better using componential analysis (Kubota and Toyoda, 2001; Flaherty and Noguchi, 1998). One of the links in the same site leads to an interview article with James W. Heisig who is the author of a book for autonomous *kanji* learning called '*Remembering the Kanji I: A Complete Course on How Not to Forget the Meaning and Writing of Japanese Characters*' - http://www.kanjiclinic.com/riverainterview.htm. Heisig took the componential approach and mastered to learn how to read and write *kanji* autonomously. However, although the shift from rote memory to componential analysis is a welcome achievement, the current form of componential analysis has not moved out of the realms of memory strategy. In order to develop L2 learners' word recognition skills, explicit instruction on the functional components, in which frequency, transparency/regularity and consistency of both main radicals and phonetics have been taken into consideration, is called for. Awareness of usefulness and limitations of functional components would be great help for autonomous vocabulary learning.

4) Making use of the information conveyed by constituent *kanji* characters

When L2 learners start to encounter a number of multi-kanji words, it is recommended that they learn the function of the constituent characters in a word. It is widely claimed that each constituent character in a word usually has the role of a morpheme (Taft and Zhu, 1997a; Zhang and Peng, 1992) although a few words cannot be segmented into morphemes (Taft and Zhu, 1997b). This suggests that the meaning of a compound word is often a combination of the meanings of the constituent morphemes. For example, Hatano (1986) reported that his Japanese native speaker participants were able to infer the meanings of unfamiliar technical words (*kango*) from their constituent *kanji.* The website called 'Teach Yourself Japanese' - http://www.sf.airnet.ne.jp/ts/japanese/message/jpnDwlWNqXkDwjfGuYF.html - argues that *kango* is 'organized' vocabulary, that is, a set of complex words that can be derived from simple words (i.e., single-kanji words). The given example *kango*, 傑作 /kessaku/ (masterpiece), 名作 /meisaku/ (magnum opus), 力作 /rikisaku/ (tour de force), 佳作 /kasaku/ (chef d'oeuvre)、秀作 /shuusaku/ (acme of perfection) are all derived from a single-*kanji* word, 作る /tsukuru/ (to make). Knowing

the function of the constituent characters in a word would help learners recognize and reproduce numerous *kango.*

Moreover, some *kango* are in fact a core word and an affix. The knowledge of affix *kanji* may be of a great help in interpreting the meanings of the words. For example, 多言語 /tagengo/ consists of a prefix meaning 'multi-' and a compound word 'language'. Other characters that have a role of a prefix include: 全 (all), 各 (each), 諸 (various), 再 (re-, again), 未 (un-, not yet), and 不 (in-, un-, not). Examples of ones that have a role of a suffix are: 化 (-tion, become), 的 (-cal, of), 性 (-ty, nature), 中 (in the middle of), 者 (-er, or, person), and 所 (place). There are many more characters that act as an affix. In order to support learners' autonomous vocabulary learning, the affix *kanji* should be taught with the special attention to their function in a word.

Becoming aware that the majority of *kanji* characters can act as a morpheme in a word is indeed critical for autonomous learning. Besides the knowledge of affix *kanji*, knowing whether or not the constituent kanji in a word can be a stand-alone word would help learners access the meaning of the compound word. The degree of semantic relatedness between a word and its constituent character(s) and between words sharing a common character varies. The relationship is sometimes transparent, and sometimes less so, depending mainly on whether or not the constituent character has a status as a free morpheme, except for the cases of affix characters. Of the 1,945 Japanese general-use *kanji*, 700 are used to represent free morphemes, i.e., words (Yamada, 1998). With only a very few exceptions, these free morphemes (*kanji)* have a semantic reading, the *kun*-reading, that represents a Japanese native word. In other words, these *kanji* can be single-*kanji* words in other contexts. Therefore, the meaning of a *kango* (multi-*kanji* word) may be inferred from the single-*kanji* words that act as free morphemes in the word. 'Rikai' - http://www.rikai.com/perl/Home.pl - is a perfect site for learning the meanings of each constituent *kanji* in a *kango*. By moving a mouse over the target *kango*, the following information pops up: the reading and the meaning of the *kango* and the readings and meanings of all the constituent *kanji*. When using this site, the focus should be on learning the relationship between words and their constituent characters, otherwise, the information given may be overwhelming for L2 learners. The website called 'Kanji Game' - http://www.msu.edu/~lakejess/kanjigame.html - has some *kango* quizzes (compounds games) where learners can try to infer the meanings of *kango* from the meanings of individual kanji.

Explicit instruction on the readings of *kanji* characters is most essential, as this is unique to Japanese *kanji* characters. Although researchers often equate Japanese *kanji* with Chinese *hanzi*, as many characters are shared between the two languages, Japanese *kanji* and Chinese *hanzi* in fact have distinct features, the most prominent one of which is phonology. As mentioned above, a large number of Japanese *kanji* have two types of readings (*on*-reading and *kun*-reading) whereas the majority of Chinese *hanzi* have only one reading (Tamaoka, 2003). When discussing the phonology of *kanji* characters, the two types of readings should not be mixed. *Kun*- and *on*- readings have no relationship (Tamaoka, 2003; Taylor, 1998), as they are from two unrelated languages, Japanese and Chinese (Taylor, 1998). *Kun*-reading usually shows the concept of the individual *kanji*, and *on*-reading only shows one of the readings of the constituent *kanji* of a word (Taylor, 1998). For this reason, *kun*-reading is sometimes called semantic reading, and *on*-reading, phonetic reading (Hatano, 1986). It is extremely critical that this distinction is made clear to L2 learners from the start of vocabulary learning/ teaching. Most textbooks for L2 Japanese present both *kun*- and *on*-readings without any explanations for having the two distinctive readings. The difference between the two needs to be explained at the start of the study of Japanese vocabulary and should be revisited over and over throughout the course.

*Kango* are the multi-*kanji* words that are read in the *on*-reading (Kitahara, 2003). In the case where the phonological representation of the *kango* is familiar to the learner and the learner is able to read the word correctly, the meaning of the word may be activated via the phonological route. However, when the *kango* is unfamiliar to the learner, knowing the *on*-readings of the constituent *kanji* may not help access the meaning of the whole word. This is because, as described above, *on*-readings are simply the Chinese readings of *kanji* and are not linked to meanings. Research suggests that processing *kun*-readings involves the activation of semantic representations prior to phonological activation while *on*-readings have direct links to the activation of phonological representations (Kaiho and Nomura, 1983).

Another reason that the *on*-readings may not be very helpful in accessing the meanings of *kango* is that there are many *kango* that are read in exactly the same way. The large number of homophones in Japanese is attributed to the fact that, owing to fewer syllables and the absence of tones in Japanese, Chinese characters, *hanzi* that had similar readings and those that had the same reading but different tones resulted in many homophones in *kanji* (Tamaoka. 1991). Therefore, inferring the meanings of unfamiliar *kango* from the *on*-reading of individual constituent *kanji* may not be practical. As well as learning the reading of the *kango* (that is, learning the *on*-readings of the constituent characters), learners may need to know the meaning-bearing readings, which are the *kun*-readings in most cases, of the characters in order to access the meaning of the word. The website 'Kanji Uta' - http://www.nipponhyojun.co.jp/kanji/kanjiuta.html - offers exercises for learning words in the *on*- and *kun*-readings in sentences. When clicking a *kanji* in the table of *kanji*, a sentence containing two target words (derived from the same *kanji*) appears. One of the two words is a word in the *on*-reading, and the other word that contains the same *kanji* is a word in the *kun*-reading. For testing the knowledge of *on*- and *kun*-reading, the website 'Drill and learn the Japanese kanji' - http://www.asahi-net.or.jp/~ik2r-myr/kanji/kanji16a.htm - may be helpful. These websites should be used with caveats in mind, as they treat the *on*- and *kun*- readings on the same level.

In summary, it is important to learn *kango* as a combination of *kanji* characters, which act as morphemes in the words. Although *kango* words are usually introduced to learners without focusing on the individual constituent characters, explicit instruction on the morphemes (in the meaning-bearing readings) is more likely to make learners aware of the relationships between *kango* sharing a common *kanji*, and such awareness would enhance autonomous vocabulary learning.

5) Analyzing the syntactic and semantic information.

Vocabulary acquisition entails learning not only orthographic, phonological and morphological information of the word but also peripheral syntactic and semantic information to complement it. Research suggests that 'word integration' skills, i.e., skills for integrating words into phrase and clause structures, is strongly related to reading comprehension (Fender, 2001). Integration of information from the multiple sources is certainly a better strategy than learning from a single source (Mori and Nagy, 1999). In this regard, instruction on word recognition skills should be extended to integration skills, which are also critical for enhancing autonomous vocabulary learning.

One of the difficulties that L2 learners experience with learning *kango* is that the part of speech is not apparent from the word form. For example, the *kango*, 細部 /saibu/ (detail), 細心 /saishin/ (prudent), 細分 /saibun/ (subdivide), consist of two *kanji*, one of which is common to all. However, their parts of speech are all different. 細部 (detail) is used only as a noun, 細心 (prudent) can be a noun or an adjective, and 細分 (subdivide) is a gerund. It is important to bring learners' attention not only to the target words but also the function words to follow. Nouns are often followed by the

particles such as が /ga/ and の /no/, adjectives usually take an adjective marker, な /na/, and a gerund *kango* can be identified by the 'to do' verb, する /suru/, that follows. The syntactic information such as these complement the information from the target words (Mori, 2003). L2 learners should be encouraged to learn *kango* in a phrase rather than a word.

Learning about the semantic constraint of *kango* is also critical. Words permit and require certain types of words to co-appear in texts. (Fender, 2001). In Japanese, compared to *wago*, *kango* carry more restricted meanings, which impose rigid semantic constraint on collocating words. For example, there is only one *wago* for 'to divide', 分ける /wakeru/, and the required noun phrase could be almost anything that can be divided. On the other hand, there are a number of *kango* meaning 'to divide something in a certain way', such as 分析する /bunseki-suru/ (to analyse - divide and decide), 分割する /bunkatsu-suru/ (to segment - divide and break), 分断する /bundan-suru/ (to interrupt - divide and cut off), 分配する /bunpai-suru/ (to distribute - divide and deliver), 分担する /buntan-suru/ (to share - divide and carry), 分解する /bunkai-suru/ (to resolve - divide and untie), 分譲する /bunjou-suru/ (to subdivide the land - divide and hand over), and 分離する /bunri-suru/ (to separate - divide and leave). These gerund *kango* only permit a limited number of words to collocate. L2 learners who are exposed to a large number of *kango* are required to know subtle differences between synonymous *kango*, let alone differences in usage between *kango* and *wago*. The website, ALE-Net offers short exercises for *kango* and *wago* - http://www.ale-net.com/hpcs/koku/gairaigo/try/try.htm. However, more sites of this sort are in demand. As a *kango* is used only in a specific context, it should be introduced to learners in several phrases and /or sentences, with an emphasis on neighbouring words. For concurrently appearing words, 'Denshi Jisho' - http://jisho.org/ or 'Eijiro on the Web' at http://www.alc.co.jp/ may be useful. 'WWWJDIC' - has a fantastic function http://www.csse.monash.edu.au/~jwb/cgi-bin/wwwjdic.cgi?10 - which shows example sentences containing the target *kango* with English translation of the sentences. By examining many examples, learners may autonomously learn the restricted meanings of *kango*, which are not easy to be acquired through direct translations of the words.

## Conclusion

The present paper reviewed studies in word-level processing skills and related areas and profiled how the development of recognition and integration skills would contribute to autonomous vocabulary learning. Despite the fact that the acquisition of a significant number of *kango* is critical for effective reading comprehension (Shimomura and Yokosawa, 1991), acquiring *kango* (Sino-Japanese words) is often hindered, particularly for learners with an alphabetic background, by the unfamiliar script, complex features of constituent characters, non-transparent word construction and non-apparent word usage. Although *kanji* vocabulary teaching methods for L2 learners of Japanese have advanced considerably over recent years, there are still many aspects that could be improved.

This paper, by focusing on *kango*, argued that explicit instruction on the use of intra-word clues such as the structure and functions of words and their smaller functional units, and complement clues such as syntactic and semantic information of neighbouring words, would be able to overcome the difficulties and enhance autonomous vocabulary learning. The main points made in the paper were:

1) An introduction to the Japanese writing system including the significance of *kango* should be provided to learners prior to the start of vocabulary instruction in order to give them an overview of what is entailed in their study;

2) The graphic patterns of *kanji* and the forms and locations of basic radicals should be introduced before presenting the meanings, readings and usages of individual *kanji* characters in order to enhance the development of character segmentation skills and radical identification skills;
3) Exercises to raise learners' awareness of the functions and limitations of the functional components should be provided in order to enhance the development of skills to use the information carried by the functional components effectively;
4) The function of constituent characters of *kango* should be highlighted in order to enhance the development of skills for using the morphological and phonological information generated from the constituent characters in a word.
5) Opportunities to learn the syntactic and semantic constraints of *kango* should be given in order to enhance the development of skills to use *kango* words in phases and sentences appropriately.

This skill development approach may seem to contradict a more top-down approach. Krashen (1989), for example, argues that vocabulary should be acquired through reading activities, as words need to be learned as integral part of discourse. However, the argument for vocabulary acquisition through reading has been established on the assumption that readers have an ability to extract critical information from words that they encounter in the text. Novice L2 learners, in most cases, do not possess such ability. They need to be trained to process unfamiliar words analytically in order to be able to recognize words and integrate them into phrase and clause structures skillfully in texts, and acquire vocabulary through repeated successful processing experience. With appropriate word recognition and integration skills, learners are likely to be efficient in looking up in dictionaries, memorizing, inferring the meanings and readings, and using words. Fluent word recognition and integration skills also allow learners to allocate more working memory capacity for higher order comprehension operations (Fender, 2001; Stanovich, 1982).

Given that classroom vocabulary instruction is limited, dedicating the class time to develop word recognition and integration skills seems to be more effective than giving out lists of new vocabulary. Although still limited, there are a number of useful websites and online dictionaries for assisting such explicit instruction. L2 learners may be able to acquire word-level processing skills even without any explicit instruction, however, with explicit instruction supported by technology, L2 learners are likely to become autonomous vocabulary learners much quicker than ever.

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Recommended websites

Online Japanese Writing System
http://www.kanji.org/kanji/japanese/writing/outline.htm

Wikipedia
http://en.wikipedia.org/wiki/Sino-Japanese.

About: Jaspanese Language
http://japanese.about.com/library/weekly/aa070101a.htm

Radical index
http://www.*kanji*dict.com/demo/radicals.html.

Gakushuu Anime no Yakata
http://meiko.web.infoseek.co.jp/

WWWJDIC (multiradical kanji)
http://www.csse.monash.edu.au/~jwb/cgi-bin/wwwjdic.cgi?1R

WWWJDIC (example search)
http://www.csse.monash.edu.au/~jwb/cgi-bin/wwwjdic.cgi?10

Kiki's Kanji Dictionary
http://www.nuthatch.com/kanji/demo/frame.html

Kanjigraphy. Com
http://www.*kanji*graphy.com/mainpages/info/history.html

Kanji Clinic (previous columns)
http://www.kanjiclinic.com/preart.htm

Kanji clinic (other articles)
http://www.kanjiclinic.com/riverainterview.htm

Teach Yourself Japanese
http://www.sf.airnet.ne.jp/ts/japanese/message/jpnDwlWNqXkDwjfGuYF.html

Rikai
http://www.rikai.com/perl/Home.pl

Kanji Game
http://www.msu.edu/~lakejess/kanjigame.html

Kanji Uta
http://www.nipponhyojun.co.jp/kanji/kanjiuta.html

Drill and learn the Japanese kanji
http://www.asahi-net.or.jp/~ik2r-myr/kanji/kanji16a.htm

ALE-Net
http://www.ale-net.com/hpcs/koku/gairaigo/try/try.htm

Denshi Jisho
http://jisho.org/

Eijiro on the Web
http://www.alc.co.jp/

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