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Radical Awareness Among L2 Chinese Learners: Chinese vs. Non-Chinese Spheres[1]

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Abstract

The present study aims to investigate the awareness of radicals by the learners of Chinese as a second language (CSL) from Chinese- and non-Chinese character spheres. Three comprehension tasks (i.e., a character decision task, a character meaning task and a semantic cueing function task were conducted to examine 40 participants' implicit knowledge of Chinese radicals and their use of such knowledge in identifying legal characters as well as in retrieving the meanings of unfamiliar characters.

The results show remarkable performances in the identification of ill-formed target characters by the L2 participants indicating that they had the awareness of radicals in terms of their positional regularity. In addition, the performance in character meaning inference was crucially dependent upon character transparency. Moreover, the facilitation of context was attested in meaning retrieval of unfamiliar characters. In most cases, the supplement of contextual clues was helpful for the participants, especially for those in the non-Chinese-character sphere low-intermediate group.

Keywords: second language acquisition, character recognition, semantic radical awareness, Mandarin Chinese

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1. Introduction

Understanding radicals plays an essential role in Chinese learning, and it enables learners to perceive and interpret the meanings of characters or words since characters sharing identical radicals often have related meanings. For instance, "河" (hé 'river'), "沐" (mù 'bath'), and "洗" (xǐ 'wash') all share the identical semantic radical "氵(water)" and are all semantically related to water. In order to grasp the meaning of the characters, one must understand how characters are formed before they can correctly interpret them. However, some research (e.g., Shi, 1999; Liu, 2005; Lu, 2013; Cai, 2014) on the errors made by non-native learners of Chinese as a second language (CSL) in writing Chinese characters found that the knowledge of radicals was not fully understood or was even misinterpreted by CSL learners, which leads to a wrong substitution of components within characters or a misplacement of radicals, thus resulting in incorrect or nonexistent characters. In Lu's (2013) analysis of Deng's database[3] of Chinese characters by learners from non-Chinese character spheres, several types of errors were found. For instance, the target character "話" (huà 'words') was written as "活" (huó 'to live'), in which the semantic part on the left was wrongly substituted by 氵(water), producing a character carrying a totally different meaning. Another example is also taken from Lu (2013), in which the correct target character "和" was written in the reversed order, yielding a nonexistent character  . This kind of mirror image error was also found in Japanese CSL learners (Cai, 2014), indicating that even learners with a logographic writing system in their first language produced errors in their Chinese characters. Since such writing errors were made by Japanese learners, it would be intriguing to see if CSL learners with an alphabetic language background (e.g., English) encounter similar obstacles. Thus, the present study aims to find out whether CSL learners of different L1 writing systems attend to the components of Chinese characters during their process of learning Chinese.

Chinese has a logographic writing system in which each Chinese character represents a syllable instead of an individual phoneme in spoken language (e.g., Shu & Anderson,

[3] The database, established by Dr. Shou-shin Teng at National Taiwan Normal University from 2006 to 2008, collected writing errors in Chinese characters from non-Chinese character sphere CSL learners.

1997; Whitney, 1998; Feldman & Siok, 1997) and it is a logogram that represents a lexical morpheme[4]. For example, the character "泳" (*yǒng* 'to swim') consists of two radical parts, which are" 氵(water)" and "永". The arrangement of components in a Chinese character structure can be diverse.[5] In addition, Chinese characters can be categorized into four types according to the manner by which they are formed or derived.[6] Of all the types of Chinese characters, phonetic-semantic compounds are mostly used in daily life (Kang, 1993; Shu & Anderson, 1997; Ho et al., 2003; Wang & Koda, 2013; Su & Kim, 2014; Kuo et al., 2015; Tong et al., 2017). As indicated by the term 'phonetic-semantic compounds,' this type of characters comprises a semantic radical and a phonetic radical, each of which carries either the meaning or the sound of the character.

Several features of semantic radicals have been specified in previous studies (e.g., Shu & Anderson, 1997; Ho et al., 2003; Shen & Ke, 2007; Wang & Koda, 2013; Su & Kim, 2014; Kuo et al., 2015; Zhang et al., 2016; Tong et al., 2017; Loh et al., 2018). First, they provide semantic categories for phonetic compounds. In other words, the meaning of a Chinese character can be inferred directly or indirectly from the information given by its semantic radical. Second, they in most cases have habitual positions in characters. Mostly, they are located on the left in left-right structures or on the top in top-bottom structures. Third, semantic radicals can either be free-standing characters by themselves or they are bound forms which only appear in compound characters. Phonetic radicals, on the other hand, often cue the pronunciation of the phonetic compounds. Simply put, if a comprehensive knowledge of radicals were emphasized in instruction and given to CSL

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[4] There are three tiers in a character's orthographic structure (Shen & Ke, 2007). Strokes are the smallest units inside a character. They are constituents that contribute to the formation of a radical. For instance "永" (*yǒng* 'perpetual') is a pictograph that is constructed of eight basic strokes. As for the radical formed by strokes or stroke patterns, it is the part that represents the smallest meaningful orthographic units within a Chinese character.

[5] Various configurations can be seen in the formation of Chinese characters. Characters can be configured in a left-right structure (e.g., 針), a top-bottom structure (e.g., 雲), an inside-outside structure (e.g., 圍), a half-enclosure structure (e.g., 風), etc. (Shen & Ke, 2007; Zhang et al., 2016).

[6] There are four types of Chinese characters, namely, *Xiàngxíngzì* 'pictographs; *Zhǐshìzì* 'ideographs; *Huìyìzì* 'compound ideographs'; and *Xíngshēngzì* 'phonetic-semantic compounds (Martin, 1972; Tung, 2014).

learners, it would greatly support them in their learning of Chinese.

To further understand whether CSL learners pay heed to the components within Chinese characters, which are crucial in reaching the correct interpretation of what an ideal character is like or the meaning of an unfamiliar character, the present study addressed the following research questions:

1. Do CSL learners possess the awareness of Chinese radical positions when they learn Chinese?
2. Can CSL learners make use of radical information to infer the meanings of novel characters?
3. Does radical information help CSL learners infer the meaning of novel characters in isolation (i.e., word) and in context (i.e., sentence)?

2. Literature Review

2.1 Radical Awareness and Character Recognition

Three previous studies of how radical awareness, including its internal structures and function, affects the recognition of Chinese characters by nonnative learners of Chinese are reviewed. Experiments concerning the development of radical knowledge by nonnative learners of Chinese were conducted (Taft & Chung, 1999; Su & Kim, 2014; Kuo et al., 2015).

Taft & Chung (1999) investigated whether radicals could help L2 learners memorize characters since recognition of Chinese characters is assumed to be affected by their components (D'Arcais et al., 1995; Taft & Zhu, 1997; Feldman & Siok, 1997). For native Chinese-speaking children, a systematic approach to radical instruction is not necessarily given in class (Shu & Anderson, 1997). As for learners of CSL, radical knowledge is not necessarily addressed to them. Instead, characters are learned by rote, which means a stroke-by-stroke practice is delivered most of the time. Thus, a research question arose to find out if better character recognition could be reached through instruction in radical information. Forty Australian participants, ignorant of Chinese and Chinese character

structures, were asked to recall the meanings of 24 characters after they had been exposed to these characters three times. To see whether radical knowledge could facilitate memorizing characters' meanings, the researchers divided the participants into four groups depending upon different stages at which radical instruction would be delivered. In the first recall task, the participants were required to write down the meaning of every character immediately after seeing all of the characters three times. The second recall task was conducted a week later, following the same procedure as was done the first time.

The results showed that extra specifications of radicals obviously had a positive impact on the recall of character meanings. Among the four groups, those with radical instruction outperformed the one group without it in the immediate recall task, revealing that such instruction did help retain character information. It is also noticeable that the "No Radical" group performed worse than the other groups in both recall tasks, proving the significance of radical knowledge. If granted substantial information on how characters are constituted, the participants would be able to memorize characters more easily.

Su & Kim (2014) investigated the relationship between radical knowledge and written word recognition among CFL (Chinese as a foreign language) learners. Adopting previous studies revealing that orthographic and morphological knowledge played predictive roles in literacy development of alphabetic languages (e.g., Carlisle, 2000; Cunningham et al., 2001; Kim, 2010), they speculated that a similar influence would be found in literacy acquisition of Chinese. Facets concerning radical knowledge, mostly for the purpose of reaching the legal character formation, were targeted in the study, including semantic radicals' regular positions and their functions, because an understanding of constraints on positions had been proved highly related to character recognition (Chen et al., 1996). Research questions were to find out whether CFL learners with higher Chinese language proficiency possessed better understanding of semantic radicals than those with lower Chinese language proficiency, and also the relations between the knowledge of semantic radicals and word recognition among CFL students. Ninety-seven college students took part in the study. All of the participants were chosen from 10 classes of various levels and curriculums at the university. Three tasks assessing four dimensions of knowledge of semantic radicals were administered, including a receptive task of radical positional

regularity, a receptive task of semantic radical function, and a productive task of position regularity and function of semantic radicals.

The results showed that the CFL participants with higher proficiency possessed a higher level of knowledge in radicals. The participants with higher Chinese language proficiency outperformed those with lower Chinese language proficiency on all the tasks. What is more, a positive and significant relation between knowledge of semantic radicals and word recognition was found. Similar findings shared between previous L1 studies (Ho et al., 2003; Packard et al., 2006) and the present L2 study all revealed the importance of semantic radical knowledge in specifying character configuration and processing character meanings. Findings of this study also showed that the concept of treating Chinese characters as composed of parts started to evolve and advance from the beginning stage for CFL learners.

Kuo et al. (2015) investigated the correlation between properties of Chinese characters and the individual differences among adult English-speaking beginning learners. Two hypotheses were brought up: a) characters with less visual complexity and the presence of radicals were easier to learn; b) awareness of radicals came into effect with Chinese characters carrying radicals. In other words, acquisition of characters without semantic radicals would not associate with radical awareness. Twenty-three adult English-speaking beginning learners of Chinese in Grade 10 were recruited. A character acquisition task and a radical awareness task were the two measures used in the experiment. The former aimed to examine the influence of visual complexity and radical presence on radical acquisition while the latter assessed differences among individuals in acquiring characters of different properties. Forty-eight pseudo-characters were created and categorized into four types according to their configuration of radical position and the number of strokes.

It was found that both properties of characters (visual complexity & radical presence) showed a considerable significance on the acquisition of Chinese characters. Visual complexity significantly influenced all the participants on their character acquisition. A better performance was also observed among characters with less visual complexity, which meant characters with fewer strokes were friendlier to the learners. This finding was consistent with Kuo et al.'s (2014) results. One suggested reason attributed the differences

in the ease of processing characters of different visual complexity to the limited working memory capacity, and it indicated that a greater load on working memory was required in dealing with complex characters. As for variables in the presence of radicals, it was found that the acquisition of characters with radicals was easier than those without radicals. Association of meaning with form provided by the presence of radicals is helpful in character recognition and meaning acquisition. A significant correlation between character acquisition and radical awareness was also confirmed.

To sum up, knowledge of Chinese radicals has been widely discussed in the above literature, including their positions and functions (Su & Kim, 2014; Kuo et al., 2015). Findings of the four studies all suggest that radical awareness plays a crucial role in Chinese character recognition (Taft & Chung, 1999; Su & Kim, 2014; Kuo et al., 2015). Such awareness of radicals facilitates the character learning process and it can be utilized by adult L2 learners to acquire characters, to identify well-formed characters, and to infer meanings and pronunciations of novel characters from learnt radicals.

2.2 Radical Awareness and Word Knowledge

Extending character recognition to word recognition, we find that the meaning of a Chinese word highly relates to its components, that is, its radical(s). Several studies, including L1 and L2, have all shown the close relevance of how word meanings can be inferred from a grasp of radical awareness (Shu & Anderson, 1997; Shen & Ke, 2007; Wang & Koda, 2013). Properties of radicals, including both the transparency of semantic radicals and the regularity of phonetic radicals, have impact on the development of radical awareness, which contributes to deriving word meanings.

Shu & Anderson (1997) addressed several radical-related issues by conducting two experiments designed to assess the influence of radical awareness. The first experiment consisted of 220 elementary students from six classes in Beijing, and the second experiment further recruited 39 third- and 33 fifth-grade participants from the first experiment. The results showed that the participants, regardless of grade, performed better on familiar characters. The importance of morphology was found to increase when familiarity of

characters dropped, revealing that the participants did make use of morphological structure in learning or memorizing those unfamiliar characters. Radicals were found helpful in character learning in that the participants made use of them to make inferences in understanding unfamiliar characters. In addition, it was found that the information provided by radicals was crucial in dealing with new characters for both third and fifth graders. By having enough radical knowledge within characters and understanding the morphological construct, the participants were able to learn unfamiliar characters. Overall, the results of Shu & Anderson (1997) demonstrated that the awareness of radicals within characters and the relationship between radicals and word meanings were evidently found in Chinese children, and that development of morphological knowledge evidently advanced with age. What is more, their findings obtained from the second experiment revealed that several factors were indispensable for analyzing meanings of unfamiliar characters by the participants: the knowledge of semantic information of radicals, ease of radical concepts, and the strategy to derive unfamiliar character meanings.

In Shen & Ke (2007), 140 adult English-speaking participants, aged from 18 to 26, at four learning levels (one month to three years of experience in learning Chinese) from nine institutions in the U.S. participated in four tasks: a radical perception test, a radical knowledge test, a radical knowledge application test, and a vocabulary test. A positively linear and steady developmental trend was found in the radical perception test and the radical knowledge test. Radical knowledge and perception increased as level advanced. The development of perception also indicated that the English learners of Chinese were able to decompose characters into radical units at the very beginning stage of learning. It was suggested that this rapid development of perception might be influenced by two factors: one was the cognitive maturity in perceptional organization; the other was the participants' experience at school. However, there was a plateau phenomenon in the radical knowledge application test, showing that a great performance in perceiving radicals did not contribute to equal mastery over radical knowledge. To sum up, radical knowledge was found to play a significant role in learning new characters. The participants gained awareness of radical units at the beginning stage of learning. Once they got more and more familiar with character knowledge such as sounds, shapes, and meanings, they were more skilled at character learning.

Transparency levels in characters set in different conditions were investigated by Wang & Koda (2013). The 37 participants recruited were all first year students who took a Chinese program at Pittsburgh University. Fifteen frequent semantic radicals were selected from the participants' textbook. Fifteen transparent characters, along with 15 semitransparent characters and 15 target radicals were chosen for a character meaning inference task in both isolated and contextual conditions. Three tasks were designed: a screening radical meaning task, a character meaning inference task in insolation, and a character meaning inference task in context. In response to their question about whether semantic transparency affected the inference meaning of novel characters in isolation, the answer was affirmative. Apparently, the gap of mean accuracy clearly showed that transparency of characters did affect the inference of meaning of novel characters. Meanings of transparent characters were more easily inferred because they contained reliable radical information. As for the question about whether partial radical information helped in inferring novel character meaning in isolation, the results were also positive. Compared to the 36.5% mean accuracy on single-unit characters, semitransparent characters still facilitated learners in reaching meanings by giving indirect hints to the meaning of whole characters. With regard to the question concerning whether transparency of semantic radicals influenced the inference of meaning of novel characters in context, the answer was also yes. And for the question as to whether partial radical information was helpful in inferring novel character meanings in context, the answer was no, a finding which could possibly have resulted from the learners' low level of language proficiency, according to some previous studies (Bensoussan & Laufer, 1984; McKeown, 1985; Huckin & Bloch, 1993). An account was given to explain that learners with higher language proficiency would first use their sufficient linguistic knowledge in inferring meanings of novel characters. This knowledge would include an ability in morphological analysis which would enable learners to decompose and understand characters in detail. If the analysis did not work out, learners would then resort to the assistance of contextual clues. However, in this study the poorer performance on semitransparent characters in context than in isolation was further analyzed, and it was found that the errors showed the participants relied too much on the context, thus leading to a lower level of accuracy in performance. Generally, the transparency level of characters was proved crucial and helpful in inferring meaning,

which indicates the importance of radical recognition.

The contribution of morphological awareness to word meaning is confirmed in the above studies (Shu & Anderson, 1997; Shen & Ke, 2007; Wang & Koda, 2013). For native children, the ability to decompose characters into meaningful units and make use of the knowledge provided by semantic radicals in reading improved with grade (Shu & Anderson, 1997). Besides this, it was found that an awareness of semantic radicals developed at the beginning stage of learning among nonnative learners of Chinese (Shen & Ke, 2007).

2.3 Radical Awareness and Reading Comprehension

Awareness of radicals includes the understanding of orthographic units, semantics, and phonetics. This knowledge can also be capitalized on to reach sentence meanings in context, in which readers can obtain lots of information from surrounding characters.

Ho et al. (2003) aimed to find out the relation between Chinese children's radical knowledge and their performance, and also the process of acquiring different aspects of radical knowledge among children. Two studies were conducted to investigate the development of both semantic and phonetic radical knowledge. In the first study, 60 Hong Kong primary school students of Grades 1, 3, and 5 were recruited to complete five tasks: a character decision task, a radical position judgment task, a semantic-relatedness judgment task, a semantic category judgment task, and a Chinese pseudo-character meaning judgment task. In the second study, another 60 children from Grade 1, Grade 3, and Grade 5 in another primary school in Hong Kong were asked to complete similar tasks.

The results of the two studies were similar, which again showed that knowledge of character structure had developed early. The knowledge of positions of semantic radicals was acquired earlier than that of functions of semantic radicals, and semantic radicals outperformed phonetic radicals in possessing greater positional regularities. An initial understanding of character structure was found among the first graders, and such knowledge progressed with age. In addition, the first grade participants showed a poor realization of semantic function, but not the third or fifth graders. Likewise, the findings of the character decision task showed that knowledge of radical positions was acquired earlier

than that of radical functions. Also, in the semantic category judgment task, semantic radicals that could stand individually apparently provided more semantic clues than did bound semantic radicals. All knowledge of semantic radicals, including positions and meanings, were found to be critical in reading Chinese. As to a correlation between radicals and reading, knowledge from both semantic and phonetic radicals was instrumental in reaching character meanings in context.

Tung (2014) investigated Chinese character acquisition and reading development from native Chinese children. A new classification of Chinese characters was proposed, in which characters were classified according to familiarity, transparency, and regularity (see Tung, 2014). Sixty-three participants attended her study, with 21 second graders, 20 fourth graders, and 22 sixth graders. Each grade was given four tasks, which involved a semantic task without context, a semantic task with context, a phonetic task, and one reading comprehension task.

The overall statistical outcome demonstrated that interaction between character familiarity and transparency and that between character familiarity and context were statistically significant for the participants. As for the acquisition of phonetic compounds, transparent phonetic compounds were more accessible than opaque ones. Plus, reliance on semantic radicals in acquiring semantic-phonetic compounds was found to be significant when the participants dealt with unfamiliar ones. The difficulty in acquiring semantic-phonetic compounds lessened as the familiarity of phonetic radicals increased, and radical awareness was found in all three grades. In regard to the contextual effect demonstrated by a comparison of the semantic task without context and the semantic task with context, a statistical significance was only discovered in Grade 4. The second graders did not have enough knowledge in coping with sentence-level context while the sixth graders possessed equivalent ability when faced with both word- and sentence-level context. With respect to regularity of semantic-phonetic compounds, pronunciation of irregular characters cost all the participants more effort to acquire. Similar results were drawn in the acquisition of meanings of irregular semantic-phonetic compounds. Irregularity, along with unfamiliarity of characters, appeared to be tricky for all the task takers. Speaking of the correlation between radical awareness and reading ability, both transparent semantic radicals and

regular phonetic radicals facilitate learnability and recognition of Chinese characters, providing an insight to a better reading ability.

To summarize, rudimentary knowledge of radical positions and other features were found critical in identifying legitimate structures of Chinese characters. Functions of radicals also serve as an indication to understanding novel characters; however, the information carried by radicals may not contribute to reliable cues for inferring unknown characters containing either the same semantic or phonetic radicals from other familiar characters. Thus, learning certain characters' meanings by rote is inevitable to some extent. With regard to the development of radical awareness, it was found that native Chinese learners from primary schools were conscious of radical positions at early ages (Shu & Anderson, 1997; Ho et al., 2003; Tung, 2014; Tong et al., 2017), and nonnative learners of Chinese developed an ability to decompose compound characters into radical parts as beginners (Su & Kim, 2014). Put together, the acquisition of radical positions was obtained at an early stage in both L1 children and L2 foreign adult learners (Shen & Ke, 2007; Su & Kim, 2014). The interaction of radical awareness at word level and at sentence level is also considered instrumental. The cues given by other characters or the whole context, to a certain degree, provide clues for right answers.

3. Research Design

3.1 Participants

In the present study, a total of 50 adult participants were recruited and divided into four experimental groups and a control group. The four experimental groups consisted of 40 learners of Chinese as a second language (CSL), whose mother tongues included Japanese, Korean, English, Portuguese, Spanish, German, Finnish, and French. They were divided according to language backgrounds and Chinese proficiency levels into these four groups: the Chinese character sphere low-intermediate (CCS-LM) group, the non-Chinese character sphere low-intermediate (NCCS-LM) group, the Chinese character sphere high-intermediate (CCS-HM) group, and the non-Chinese character sphere high-intermediate (NCCS-HM) group. The control group comprised 10 native Chinese speakers. Since the

present study called for the participants who possessed a higher semantic and pragmatic knowledge, intermediate CSL learners who had the equivalence to A2 or B1 level of CEFR were the target participants. These participants, aged between 18 and 30, were studying in the seasonal program at the Mandarin Training Center (MTC) at National Taiwan Normal University (NTNU). Volumes 2 and 4 of *A Course in Contemporary Chinese* were the prescribed textbooks used at the MTC as the main learning material.[7] The native controls were either undergraduates or graduate students from National Taiwan Normal University.

3.2 Materials and Tasks

The study investigated the competence of radical knowledge among CSL learners, targeting whether the participants of different writing systems could interpret Chinese characters with the help of radicals. Instead of taking a qualitative approach (e.g., Su & Anderson, 1999), due to time limitations, the present study adopted a synchronically quantitative methodology (e.g., Su & Anderson, 1997; Wang & Koda, 2013; Tung, 2014) to uncover the mental radical representation inside the participants of dissimilar language backgrounds and Chinese proficiency.

Mimicking the tasks employed in previous literature (Ho et al., 2003; Wang & Koda, 2013; Tung, 2014), we designed comprehension tasks to investigate the participants' perceptive knowledge of Chinese radicals. In order to achieve a full understanding of how our CSL learners interpreted Chinese radicals, we conducted three tasks, one at each of three phases, in which the interactions between radical awareness and character recognition, radical awareness, and reading comprehension were discussed. A character decision task was conducted at Phase 1 to examine the participants' judgments of potential Chinese characters by identifying the feasible placement of radicals. At Phase 2, the issue expanded to the word level to probe into the participants' understanding of radical functions by carrying out a character meaning task. Finally, at Phase 3, two semantic cueing function tasks differing in the provision of context were employed.

[7] *A Course in Contemporary Chinese* is a series of textbooks that comprise Volumes 1-6.

3.2.1 Character Decision Task

Enlightened by Shu & Anderson (1997) and Tung (2014), we dichotomized the target characters into transparent and opaque types in our study. A character was defined as morphologically transparent if its semantic radical played a useful role in interpreting the meaning of the whole character whereas a character was deemed morphologically opaque if its semantic radical provided little or no help in inferring the meaning of the whole character. An example of a transparent character taken from Tung (2014) was "清" (*qīng*, 'clear'), for its semantic radical "水" (*shuǐ*, 'water') was semantically related and contributory to meaning inference of "清". An instance of an opaque character was "停" (*tíng*, 'to stop') since its semantic radical "人" (*rén*, 'people') was unconnected with the meaning of "停".

Thirty target characters with a left-right configuration, including 10 real characters, 10 pseudo characters, and 10 ill-formed characters, were utilized in this study. All 10 real characters were selected from Volume 4 of *A Course in Contemporary Chinese*, which means all the target characters were unfamiliar to the participants. Both pseudo-characters and ill-formed characters were in fact nonexistent Chinese characters. However, whereas radicals in pseudo-characters were placed in regular positions just like in real characters, in ill-formed characters radicals were placed in absurd positions and thus the ill-formed characters could hardly be regarded as real characters. Fifteen radicals were proportionately distributed among character types, but placed in different positions within each character.

The first task was a character decision (CD) task, as shown in Table 1, which attempted to find out whether an awareness of positional regularity of radicals could be observed among non-native learners of Chinese.

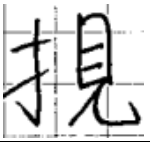
Table 1. The Classification and Number of Target Characters in the CD Task

Type of Character	Transparency of Character	Example	Number of Character
Real character	Transparent	擋	5
	Opaque	稅	5
Pseudo-character		揌	10
Ill-formed character		㚘	10
Total			30

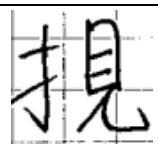
The participants were asked to choose possible real Chinese characters from 30 candidates, including 10 real characters, 10 pseudo-characters, and 10 ill-formed characters, by placing a check in the respective checkbox. An example of the test item is shown below.

Table 2. An Example of the Test Item Used in the CD Task

Example:

Expected Answers:

✓	✓	✓	
			

3.2.2 Character Meaning Task

The second task was a character meaning (CM) task, which consisted of eight real characters selected from the CD task and eight pseudo-characters as fillers, aiming to examine whether CSL learners of Chinese attend to semantic radicals for character meaning inference.

Table 3. The Classification and Number of Target Characters in the CM Task

Type of Character	Transparency of Character	Example	Number of Characters
Real character	Transparent	擋	4
	Opaque	稅	4
Pseudo-character		規	8
Total			16

Given that the semantic radical is always placed on the left in the character with a left-right configuration, it was also worthwhile to see if the participants got confused by phonetic radicals. Each item consisted of one target character and two pictures in which one was more related to the meaning of the semantic radical, while the other had a closer interpretation of the meaning of the phonetic radical in the target character. The participants were asked to choose one picture that was most semantically related to the target character. A test item of this task is given below (see Table 4) in which both (A) and (B) are considered acceptable since in Picture (A) the eyes are related to the phonetic radical "見" (jiàn, 'to see') and in Picture (B) the palm is associated with the meaning of "手" (shǒu, 'hand').

Table 4. An Example of the Test Item Used in the CM Task

Example:

1. ( )

規

(A) 

(B) 

Expected answer: (A) or (B)

3.2.3 Semantic Cueing Function Task

A follow-up semantic cueing function (SCF) task was given by using eight real Chinese characters of different degrees of transparency. To see whether context played a

crucial role in helping reach accurate word meanings, we designed this task with two types, which were the SCF task in words (SCF-W) and the SCF task in sentences (SCF-S), as can be seen below.

Table 5. The Classification and Number of Target Characters in the SCF Task

Type of Character	Transparency of Character	Example	Number of Characters
SCF-W Characters in Words	Transparent	擋	4
	Opaque	料	4
SCF-S Characters in Sentences	Transparent	擋	4
	Opaque	料	4
Total			16

Similar to Tung's (2014) design in the semantic task in words, the SCF-W in the current study was to measure participants' performance on meaning retrieval of characters at word level. There were eight test items in total. Each item contained a two-character content word, in which the target character was replaced by a blank. Two Chinese characters, including one target character and a distractor, were provided as alternatives in each item. The target character and the distractor shared an identical phonetic radical but were different in their semantic radical. An example of the test item is shown in Table 6, in which the two candidates, "擋" (dǎng, 'to keep off') and "檔" (dǎng, 'file'), can only be differentiated through their semantic radicals. The participants had to write down the number of their chosen character in the parenthesis before each test item.

Table 6. An Example of the Test Item Used in the SCF-W Task

Example:

( ) 抵___ 。 ((A)檔 (B)擋)

Expected answer: (B)

As for the SCF-S, each test item was provided with a sentence context instead of merely a two-character word. This modification was to see if the arrangement of context was advantageous to meaning inference for the participants. Again, eight real Chinese target characters of different degrees of transparency were used in eight test items that had been deliberately placed in a meaning rich context. The target character in every item was underlined and given three alternatives as possible translations. The participants were asked to choose the answer that best represented the meaning of the semantic radical of the target character in context. An example of the test item is shown in Table 7, in which (A) is applicable as to both the context and the radical (+C+R), (C) is only suitable for the context (+C-R), and (B) is related only to the radical (-C+R). Thus, the expected answer would be (A). In this task, the participants had to take context and radicals into consideration so as to select the right answers.

Table 7. An Example of the Test Items Used in the SCF-S Task

( ) On Moon Festival, Taiwanese people love sharing pomelo and 餅.
((A) a kind of edible thing (B) a kind of stale dumpling (C) a kind of meat)
Expected Answer: (A)

3.3 Procedures

There were three tasks administered: the CD task, the CM task, and the SCF task at Phases 1, 2, and 3 respectively. The CD task was given first, followed by the CM task, which, in turn, was followed by the SCF task. All the test materials were presented on printed sheets with different tasks on separate sheets. The expected time spent on each task was ten minutes with a compulsory interval of five minutes between every task in case of practice effect. Before a task was given, all participants had been asked to sign a consent form. In addition, an introduction expounding the procedures was given beforehand in order to make explicit what they would do in each task. After they had gotten ready and were well informed, the sheets for the CD task at Phase 1 were given out. At Phase 1, the participants were asked to choose possible real Chinese characters from thirty candidates in the CD task. They had to put a checkmark in the checkbox if they considered a character possible in reality. At Phase 2, the CM task was presented by asking the participants to

choose from two pictures the one that better described the meaning of the character in each test item. As to the SCF task at Phase 3, which contained two minor parts, our participants had to choose the best answers in sixteen multiple-choice questions by placing either (A), (B), or (C) in the parentheses.

By generating the mean scores for both language groups in the CD and SCF tasks in which each expected correct answer received one point while the incorrect one got no point, a descriptive analysis was derived. In the CM task, a *chi*-square test was utilized to see the frequency and tendency by examining the choices of semantic radical related and phonetic radical related answers.

4. Results and Discussion

4.1 Awareness of Radical Position in Character Recognition

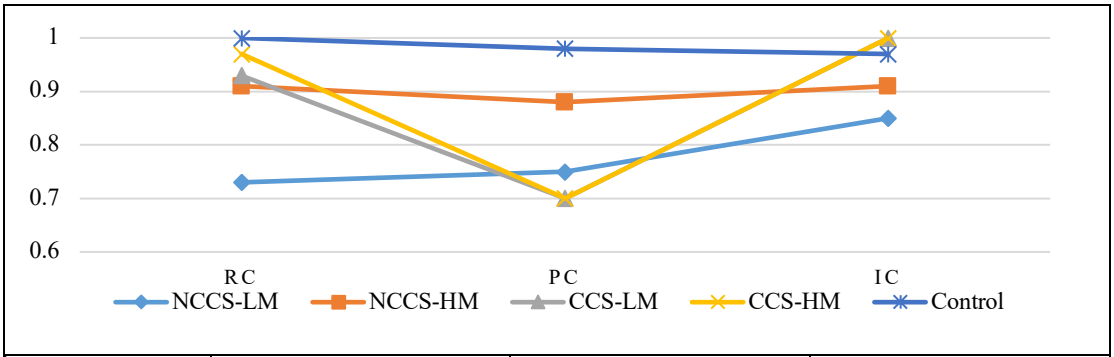
The first research question in the present study, which was investigated by administering the CD task, focuses on whether CSL learners possess an awareness of radicals in their Chinese learning. As shown in Table 8, the overall performance for our participants in interpreting ill-formed characters (M = 0.95) was better than in that of the other two types (real characters: M=0.90; pseudo-characters: M=0.80). These three types of Chinese characters were significantly different (RC: F (4, 45) = 8.453, $p < .001$; PC: F (4, 45) = 5.080, $p < .01$; IC: F (4, 45) = 5.362, $p < .001$).

Table 8. Participants' Recognition of Different Types of Chinese Characters

Type	M	SD	F	*p*-value
Real Character (RC)	0.908	0.14546	8.453	0.000036***
Pseudo-Character (PC)	0.802	0.20050	5.080	0.002**
Ill-formed Character (IC)	0.946	0.10343	5.362	0.001**

Note: ***indicates that the *p*-value is less than .001, and ** indicates the p-value is less than .01.

Also, Figure 1 below reports on the subjects' overall performance, including mean scores and SDs of the respective groups on their awareness of radical positions within the three types of characters.



Type / Group	Type 1: Real Character (RC)		Type 2: Pseudo Character (PC)		Type 3: Ill-formed Character (IC)	
	Mean	SD	Mean	SD	Mean	SD
NCCS-LM	0.73	0.17	0.75	0.11	0.85	0.15
NCCS-HM	0.91	0.14	0.88	0.15	0.91	0.11
CCS-LM	0.93	0.08	0.7	0.27	1	0.00
CCS-HM	0.97	0.09	0.7	0.18	1	0.00
Control	1.00	0.00	0.98	0.42	0.97	0.00

Fig. 1. Participants' Recognition of Different Types of Chinese Characters in the CD Task

In Figure 1 above, a comparison of the mean scores between real characters and pseudo-characters reveals an appreciable decline by participants from the Chinese character sphere (hereafter CCS) groups (CCS-LM: 0.93 → 0.7; CCS-HM: 0.97 → 0.7). That is, for the participants of the CCS groups, the acceptability ratings were reduced owing to the appearance of pseudo-characters. However, for those whose L1 is in the non-Chinese character sphere (hereafter NCCS), the accuracy rate mildly increased in the NCCS-LM group and slightly decreased in the NCCS-HM group.

In order to give a comprehensive interpretation of how the participants from different language backgrounds and proficiency levels reacted to various types of Chinese characters, the results of the CD task obtained by running a repeated measures ANOVA present the type effect within separate groups. The *p*-values were worked out by employing Fisher's LSD calculation in repeated measures ANOVA. Significant differences were found in the CCS-LM and CCS-HM groups in terms of their performance between RC and PC ($p < .05$ and $p < .01$), PC and IC ($p < .01$ and $p < .01$), and RC and IC ($p < .05$). However, no

statistical significance in an RC/IC contrast was found in the CCS-HM group, which could be accounted for by the narrow margin between mean score comparison, as can be seen in Figure 1.

With an aim to holistically analyze the results of the CD task, we brought into the discussion the correlations among several variables including learning proficiency, language backgrounds, and character types. The statistics, which were likewise obtained by running a one-way ANOVA, represent the significant differences among the five groups in terms of their performances on different types of Chinese characters. The results show that the NCCS-HM group performed significantly differently from all the other experimental groups and the Chinese native controls ($p < .01$, $p < .001$, $p < .001$, and $p < .001$, respectively) on RC. As for the PC type, the NCCS-LM, CCS-LM, and CCS-HM performed significantly differently from the native controls ($p < .01$, $p < .01$, and $p < .01$, respectively). Significant differences were also found in the comparison between the NCCS-HM and CCS-LM ($p < .05$), NCCS-HM and CCS-HM ($p < .05$). Furthermore, regarding the IC, the NCCS-LM performed significantly differently from the CCS-LM, CCS-HM, and the native controls ($p < .001$, $p < .001$, and $p < .01$, respectively). Also, the NCCS-HM performed significantly differently from the CCS-LM ($p < .05$) and CCS-HM ($p < .05$).

Regarding the between-type comparison, the major findings revealed that the pseudo-characters (PC) were more challenging than both the real and ill-formed ones for all participants except for those in NCCS-LM. As indicated in Figure 1, these graphically acceptable made-up characters apparently deteriorated the mean accuracy rate in the CCS groups in comparison with their NCCS counterparts, meaning that these specious characters posed some difficulties in the making of judgment calls.

For the ill-formed characters (IC), Figure 1 also shows that the mean scores in this type outperformed the other two across all experimental groups except for a narrow margin between the RC and IC of the NCCS-HM, which indicates that the participants possessed the awareness of character formation, to be more specific, the rudimentary positional regularity of these sub-character components. This awareness, according to Cheng (1981),

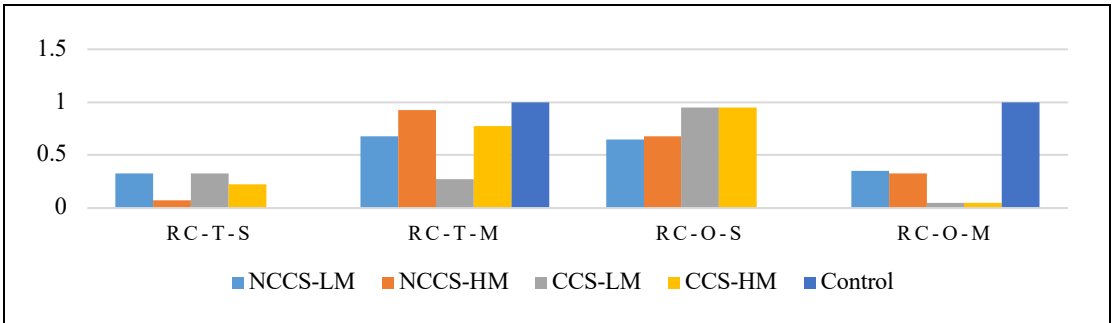
belongs to what he called general lexical knowledge[8]. Based on such knowledge, they were sensitive to the violation of character structures and were competent to tell the ill-formed characters from the real and pseudo-ones. This result corresponds to our hypothesis and had also been attested by a similar experiment in previous CSL research done by Taft et al. (1999) in which the non-characters with illegally located radicals were recognized with the highest accuracy. A similar result was reported in Wang et al. (2003) that the characters with legal radicals in illegal positions were identified and rejected more accurately than those with legal radicals in allowed positions. The participants from the CCS groups even outperformed the adult controls, reaching 100% in their average correct ration, showing that they were totally aware of what an illegal Chinese character was like by presumably taking advantage of their implicit knowledge of *kanji* characters, yet such advantage was challenged when the participants dealt with the PC. Simply put, all the participants seemed to have acquired the building blocks of Chinese character configuration, implying that such sensitivity may have been developed through previous input from their textbooks and also their teachers' instruction, and that is why they could readily filter out those characters with impossible combinations.

Speaking of the between-group comparison, it can be reviewed from two separate aspects, according to language backgrounds and Chinese language proficiency. First, mother tongue influence was manifest among the participants at a low intermediate level. For the participants of the CCS-LM, their first language substantially provided a niche while the native tongues of the NCCS-LM led to negative transfer that interfered with performance. This can be seen in a comparison between the results of RC identification. However, such influence was not salient when the learners advanced to a high intermediate level. Regarding the proficiency effect, it was found to be more distinct in the NCCS groups since a gap in RC responses was observable meaning that their sensitivity to radicals in character recognition progressed along with their learning hours.

[8] According to Cheng (1981), general lexical knowledge refers to the knowledge of a language that can be increasingly acquired over time. For instance, in Mandarin Chinese, this knowledge comprises several aspects including the rules of Chinese character formation and the cueing function of radicals in characters' sound and meaning.

4.2 Awareness of Radical Function in the Inference of Meaning

The second research question in the present study intends to see whether the CSL learners were equipped with the ability to infer the meanings of novel Chinese characters by exploiting the fractional clues that the radicals provided with a CM task. The overall results of the CM task are provided in Figure 2.



Type / Group	Type 1: Real Characters Transparent (RC-T)				Type 2: Real Characters Opaque (RC-O)			
	PR		SR		PR		SR	
	f	%	*f*	%	*f*	%	*f*	%
NCCS-LM	13	32.5	27	67.5	26	65	14	35
NCCS-HM	3	7.5	37	92.5	27	67.5	13	32.5
CCS-LM	13	32.5	27	67.5	38	95	2	5
CCS-HM	9	22.5	31	77.5	38	95	2	5
Control	0	0	40	100	0	0	40	100

Fig. 2. Participants' Interpretations of the Meaning Cueing Function from Different Types of Chinese Characters in the CM Task

Figure 2 demonstrates that most of the participants, regardless of their language background or current proficiency in Chinese learning, chose pictures representing the correct meanings of the targeted real characters with transparent properties (RC-T type). In other words, most of them were cued by the semantic radicals in the RC-T type, and the number of those choosing meaning-related pictures was at least two times more than that of those choosing sound-related ones in every group. However, such inclination flipped in the targeted real characters with opaque traits (the RC-O type) indicating that more answers

relating to phonetic radicals were selected. A great gap in the number of choices made between sound- and meaning-related items existed for both CCS groups, yielding an overwhelming majority of incorrect answers. With respect to the third type in which the target characters were actually pseudo-characters, the participants of both NCCS groups were at least twice as likely to favor meaning-related pictures above sound-related ones whereas for those in the CCS groups, the number of each was close to a fifty-fifty basis in being selected. As for the control group, all the participants accurately chose their answers in the first two types, but in the PC items their performance was close to that of the NCCS groups.

The overall *p*-values were examined for the within-group between-type differences in the CM task. By utilizing repeated measures ANOVA, it turned out that for the NCCS-LM, NCCS-HM, CCS-LM, and CCS-HM, performance on the RC-O was significantly different from that on both the RC-T ($p < .05$, $p < .001$, $p < .001$, and $p < .001$, respectively) and PC ($p < .01$, $p < .05$, $p < .001$, and $p < .001$, respectively). What's more, we also see significant differences in the high-intermediate groups when it comes to their performance between the RC-T and PC (NCCS-HM: $p < .05$; CCS-HM: $p < .01$).

Also, further analyses were conducted between groups as they coped with various types of Chinese characters. Instead of using one-way ANOVA, which reviews statistical significance by applying the means of independent variables, the results were output by conducting Pearson's *chi*-square test of homogeneity since in this CM task we aimed to analyze the observed distribution of sound- and meaning-related responses of every type of character across different groups. Significant differences were found in the compared performances between the two NCCS groups in RC-T ($p < .01$). For the NCCS-LM, CCS-LM, and CCS-HM groups, noticeable differences in the RC-T were also revealed when they were compared with the native controls ($p < .001$, $p < .001$, and $p < .01$, respectively). As for the RC-O, significant differences were exhibited in the comparison of any two groups except for that between the groups having identical language backgrounds. In regard to the interpretation of the PC, significant differences were found between any two groups of the same proficiency (NCCS-LM vs. CCS-LM: $p < .05$, NCCS-HM vs. CCS-HM: $p < .01$) and in the comparison between any CCS group and the native controls (CCS-

LM vs. Control: $p < .05$; CCS-HM vs. Control: $p < .01$).

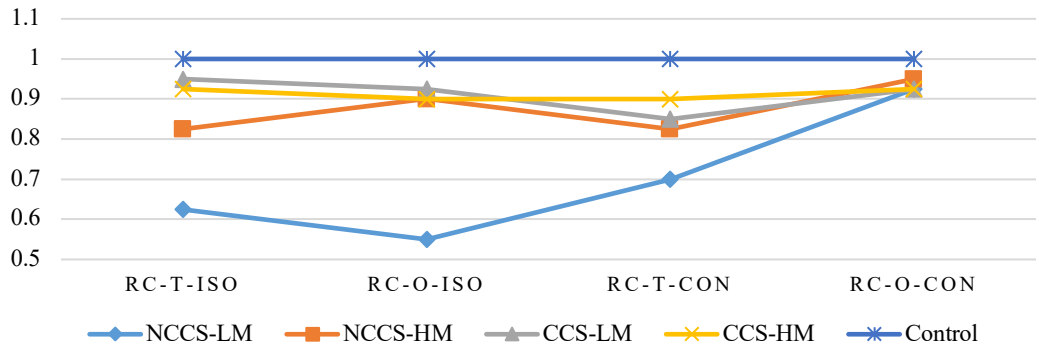
Regarding the between-type comparison, semantic radicals played a dominant role in inferring the meaning of targeted transparent characters whereas in processing the meanings of opaque characters, the participants had a tendency towards using the phonetic radicals to infer meaning. In this character-meaning matching task, which required the use of the participants' implicit knowledge of radical function, it is totally comprehensible that semantic radicals were majorly chosen as the indicators for the transparent characters since in this kind of character the relationship between the character's meaning and the meaning of semantic radical is highly related and straightforward. From the performance on the RC-T, it is suggested that an awareness of radicals in specifying the meaning of characters had been grasped by all the participants, which was in accordance with our expectation; moreover, this result confirms that of the study by Shen & Ke (2007), in which the awareness of radical function was found to improve along with years of study from the first to the fourth year. However, regarding the RC-O, the tendency switched from choosing semantic-related to phonetic-related answers. One possible reason accounting for this phenomenon might be that the participants were not able to reach an association between the meanings of target characters and their semantic radicals in the unfamiliar RC-O owing to the greater complexity of their nature; therefore, clues related to phonetic radicals became their alternative resort. To sum up, radical function in the inference of meaning was found to be governed by the features of the target characters in which character transparency acted as a contributing factor in helping to reach a successful association. This significant relation between character transparency and ease of inferring the meaning from radical components was also confirmed in an empirical study done by Wang & Koda (2013).

As to the between-group comparison, two aspects concerning the difference in distinct language backgrounds and the proficiency effect are worth noting. As can be seen in Figure 2, the effect of mother tongue for the CCS groups, considered advantageous to Chinese character learning, turned out to be apparently ineffective in RC-O interpretation, yielding erroneous judgments most of the time. Instead, this transfer was less salient in the performance on the RC-T items, which points out that a transparency effect was obvious and observable. One possible reason accounting for the strong inclination towards sound-

related choices on the RC-O for the CCS groups may be that the prudent nature of Asians hindered them from thinking straightforwardly. In addition, a proficiency effect was observed. A comparison of the performance between two NCCS groups on the RC-T, as shown in Table 13, indicates that the participants at the high-intermediate level significantly outperformed those at the low intermediate level.

4.3 Influence of Context Effect upon Awareness of Radical Function in the Inference of Meaning

The research question explores whether the insertion of contextual clues would result in any difference in the performance in inferring the meaning of novel characters by conducting the semantic cueing function (SCF) task. The participants' overall performance is illustrated in Figure 3.



Type / Group	RC-T-ISO		RC-O-ISO		RC-T-CON		RC-O-CON	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
NCCS-LM	0.62	0.17	0.55	0.28	0.7	0.19	0.92	0.12
NCCS-HM	0.82	0.82	0.9	0.17	0.82	0.23	0.95	0.10
CCS-LM	0.95	0.95	0.92	0.16	0.85	0.17	0.92	0.12
CCS-HM	0.92	0.92	0.9	0.17	0.9	0.12	0.92	0.12
Control	1	0	1	0	1	0	1	0

Fig. 3. Participants' Interpretations of Different Types of Chinese Characters in the SCF Task

In Figure 3, we, first of all, would like to describe the data to see the influence of context (CON) versus isolation (ISO) on the two types of characters (RC-T-ISO vs. RC-T-CON; RC-O-ISO vs. RCO-O-CON) among the five groups. In the NCCS-LM group, we can tell from the graph that the accuracy rate grew 8% and rose nearly 40% in the percentage for the RC-T and RC-O, respectively. For the NCCS-HM group, the accuracy rate remained unchanged for the RC-T but climbed by 5% for the RC-O. In the two CCS groups, the mean rate of the RC-T went down by 10% and 2% in the LM and HM groups, and the average percentage of the RC-O remained stable in the LM group but it rose by 2% in the HM group. On the whole, the entry of the context was relatively supportive for the NCCS groups since no decrease was found between these two populations. On the contrary, the assistance of context seemed limited for the CCS groups.

In addition, we examined the data given in Figure 3 by carrying out a comparison between the performance in the context-free task and the context-provided task regardless of character type. The statistics were obtained by running a repeated measures ANOVA to examine the interrelation between context-free and context-provided conditions in separate groups. It shows that the only significant difference appeared in the NCCS-LM ($p < .001$) indicating that the occurrence of context prominently affected and improved the accuracy of meaning inference. As for the between-group differences, the *post hoc* comparison shows that under a context-free condition, the native adults, the NCCS-HM, CCS-LM, and CCS-HM performed significantly differently from the NCCS-LM ($p < .001$, $p < .01$, p $< .001$ and $p < .001$, respectively). The adult controls also performed differently from the NCCS-LM ($p < 0.5$) but not from the other three groups. With regard to the context-provided conditions, the native controls and the CCS-HM performed significantly differently from the NCCS-LM ($p < .001$ and $p < .05$). Moreover, the participants of the NCCS-HM and CCS-LM groups also performed differently from the Chinese native controls ($p < .05$ and $p < .05$).

The purpose of the SCF task was to investigate whether context played a crucial role in helping reach accurate word meanings. According to the overall statistical outcome shown in Figure 3, the provision of context was not necessarily helpful to the meaning retrieval in both types of characters across all experimental groups. The adding of context

was beneficial to inferring unfamiliar RC-O meanings for the NCCS-LM. However, a similar context effect was not found in the CCS groups; on the contrary, context even seemed to interfere with their performance on the RC-T meaning inference. Generally speaking, the context effect was found, but its facilitation in accurate meaning retrieval was only significantly manifested in the processing of opaque characters among the participants of the NCCS groups.

Mother tongue influence was evident as revealed between any combination of the NCCS and the CCS groups at the same proficiency level. The positive transfer was apparent among the CCS participants that it assisted them in achieving accurate association in both with or without context. Moreover, this positive transfer was more salient in the comparison between low-intermediate groups. As to the variables of proficiency disparity, the significance was found across the four experimental groups, but the effect was more noticeable between the NCCS groups than the CCS ones.

5. Conclusion

The present study investigated whether CSL learners of different proficiency levels and coming from distinct language backgrounds had acquired an awareness of Chinese radicals by administering several experiments which served to discover the participants' interpretation and application of radical knowledge. The results of the three tasks reveal a distinction in radical interpretation between the CSL learners coming from alphabetic versus logographic language backgrounds. Furthermore, the outcome of the tasks also correlated with the participants' Chinese proficiency level. Therefore, two variables, those of language transfer from the mother tongue and proficiency level in Chinese learning, are summarized below.

Table 9. A Comparison of Achieved to Native-like Performance in Each Group Throughout the Tasks

NCCS-LM	CCS-LM
➢ Ill-formed character/ real character/ pseudo character: not native-like	➢ Ill-formed character/real character: native-like; pseudo character: not native-like
➢ Transparent character/ opaque character: not native-like	➢ Transparent character/ opaque character: not native-like
➢ Character in isolation/in context: not native-like	➢ Character in isolation: native-like; character in context: not native-like
NCCS-HM	**CCS-HM**
➢ Ill-formed character/real character/ pseudo character: native-like	➢ Ill-formed character/real character: native-like; pseudo character: not native-like
➢ Transparent character: native-like; opaque character: not native-like	➢ Transparent character/ opaque character: not native-like
➢ Character in isolation/in context: not native-like	➢ Character in isolation/in context: native-like

As specified in Table 9, the participants of the NCCS-LM never gave a native-like performance, showing that their awareness of radical, including positional and functional regularity, was not native adult-like. It was not surprising that their performance was hindered due to a negative transfer from their alphabetic mother tongue. In contrast, the CCS-LM group rendered much positive transfer from their first language when encountering the CD and SCF tasks; however, such positive transfer became an interference when the participants faced the RC-O in the CM task since the opaque feature caused distraction. As for the influence of a proficiency effect, an obvious difference in the performance of the NCCS-HM from that of their LM counterpart reveals that a comprehensive awareness of radicals progresses with learning experience. With regard to

the proficiency effect found in the two CCS groups, it can be said that the effect was less prominent if compared with the NCCS groups.

No study is without limitation. In the present research, owing to the time and resources, we only recruited a total of 40 participants in the experimental groups. Compared with some previous studies exploring an awareness of radicals among CSL learners (e.g. Shen & Ke, 2007; Su & Samuel, 2010), 40 participants were far from enough; therefore, the number of participants should be expanded in the future. Moreover, we have not explored the interwoven relations between character recognition, transparency effect, and contextual effect. The correlation between respective tasks can be addressed in future research.

References

Bensoussan, Marsha, & Batia Laufer. (1984). Lexical guessing in context in EFL reading comprehension. *Journal of Research in Reading, 7*(1),15-32.

Cai, Qiao-yu. (2014). The analysis of Chinese character writing and words usage errors made by Chinese-Japanese learners and suggestions. *Chung Yuan Journal of Teaching Chinese as a Second Language, 13,* 53-77.

Carlisle, Joanne F. (2000). Awareness of the structure and meaning of morphologically complex words: Impact on reading. *Reading and Writing, 12*(3),169-190.

Chen, Yi-pung, D. A. Allport, & J. C. Marshall. (1996). What are the functional orthographic units in Chinese word recognition: The stroke or the stroke pattern? *The Quarterly Journal of Experimental Psychology Section A, 49*(4), 1024-1043.

Cheng, Chao-ming. (1981). Perception of Chinese Character. *Chinese Journal of Psychology, 23*(2), 137-153.

Cunningham, Anne E., Kathryn E. Perry, & Keith E. Stanovich. (2001). Converging evidence for the concept of orthographic processing. *Reading and Writing, 14*(5-6), 549-568.

D'Arcais, Flores, B. Giovanni, Hirofumi Saito, & Kawakami Masahiro. (1995). Phonological and semantic activation in reading kanji characters. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 21*(1), 34-42.

Feldman, Laurie Beth, & Witina Wai-ting Siok. (1997). The role of component function in visual recognition of Chinese characters. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 23*(3), 776-781.

Huckin, Thomas, & Joel Bloch. (1993). Strategies for inferring word-meanings in context: A cognitive model. *Second Language Reading and Vocabulary Learning*, eds. by Thomas N. Huckin, Margaret Haynes, & James Coady, 153-178. Ablex Publishing Corporation.

Ho, Connie Suk-han, Tingting Ng, & Wingkin Ng. (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.

Kang, J. S. (1993). *Analysis of Semantics of Semantic-Phonetics Compound Characters in*

Modern Chinese: Information Analysis of Usage of Characters in Modern Chinese. Shanghai, China: Shanghai Education Publisher.

Kim, Young-suk. (2010). Componential skills in early spelling development in Korean. *Scientific Studies of Reading, 14*(2), 137-158.

Kuo, Li-jen, Ying Li, Mark Sadoski, & Tae-jin Kim. (2014). Acquisition of Chinese characters: The effects of character properties and individual differences among learners. *Contemporary Educational Psychology, 39*(4), 287-300.

Kuo, Li-jen, Tae-jin Kim, Xin-yuan Yang, Hui-wen Li, Yan Liu, Hai-xia Wang, Jeong-hyun Park, & Ying Li. (2015). Acquisition of Chinese characters: The effects of character properties and individual differences among second language learners. *Frontiers in Psychology, 6,* 1-10.

Liu, Jiang-tao. (2005). The error analysis of Chinese character by preparatory course of students. *Language and Translation, 1,* 72-74.

Loh, Elizabeth Kayee, Xian Liao, & Shing On Leung. (2018). Acquisition of orthographic knowledge: Developmental difference among learners with Chinese as a second language (CSL). *System, 74,* 206-216.

Lu, Ju-ping. (2013). *The Acquisition of Traditional Character Writing by the Learners of Non-Chinese-Character Sphere Based on the Error Analysis*. Chinese Culture University MA thesis.

McKeown, Margaret G. (1985). The acquisition of word meaning from context by children of high and low ability. *Reading Research Quarterly, 20*(4), 482-496.

Martin, Samuel E. (1972). Nonalphabetic writing systems: Some observations. *Language by Ear and by Eye: The Relationships between Speech and Reading*, eds. by James F. Kavanagh, Ignatius G. Mattingly, 81-102. Boston, MA: MIT Press.

Packard, Jerome L., Xi Chen, Wen-ling Li, Xin-chun Wu, Janet S. Gaffney, Hong Li, & Richard C. Anderson. (2006). Explicit instruction in orthographic structure and word morphology helps Chinese children learn to write characters. *Reading and Writing, 19*(5), 457-487.

Shi, Zhengyu. (1999). Error analysis of foreign students' picto-radicals of Chinese characters. *Journal of Peking University, 36*(4), 147-153.

Shu, Hua & Richard C. Anderson. (1997). Role of radical awareness in the character and

word acquisition of Chinese children. *Reading Research Quarterly, 32*(1), 78-89.

Shen, Helen H. & Chuanren Ke. (2007). Radical awareness and word acquisition among nonnative learners of Chinese. *The Modern Language Journal, 91*(1), 97-111.

Shu, Hua & Richard C. Anderson. (1999). Learning to read Chinese: The development of metalinguistic awareness. *Reading Chinese Script: A Cognitive Analysis*, eds. by Jian Wang, Albrecht Inhoff, & Hsuan-chih Chen, 1-19. Mahwah, New Jersey: Lawrence Erlbaum Associates.

Su, Yi-feng & S. Jay Samuels. (2010). Developmental changes in character-complexity and word-length effects when reading Chinese script. *Reading and Writing, 23*(9), 1085-1108.

Su, Xiaoxiang & Youngsuk Kim. (2014). Semantic radical knowledge and word recognition in Chinese for Chinese as foreign language learners. *Reading in a Foreign Language, 26*(1), 131-152.

Taft, Marcus & Xiaoping Zhu. (1997). Submorphemic processing in reading Chinese. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 23*(3), 761-775.

Taft, Marcus & Kevin Chung. (1999). Using radicals in teaching Chinese characters to second language learners. *Psychologia, 42*(4), 243-251.

Tung, Tzu-Yun. (2014). *Chinese Character Acquisition and Reading Development: Role of Radical Awareness*. National Taiwan Normal University MA thesis.

Tong, Xiuhong, Xiuli Tong, & Catherine McBride. (2017). Unpacking the relation between morphological awareness and Chinese word reading: Levels of morphological awareness and vocabulary. *Contemporary Educational Psychology, 48,* 167-178.

Wang, Jing & Keiko Koda. (2013). Does partial radical information help in the learning of Chinese characters: Converging theory and practice. *Proceedings of the 2011 Second Language Research Forum,* eds. by Erik Voss, Shu-Ju Diana Tai, & Zhi Li, 162-172. Somerville, MA: Cascadilla Proceedings Project.

Whitney, Paul. (1998). *The Psychology of Language*. New York: Houghton Mifflin.

Zhang, Jie, Hong Li, Qiong Dong, Jie Xu, & Elizabeth Sholar. (2016). Implicit use of radicals in learning characters for nonnative learners of Chinese. *Applied Psycholinguistics, 37*(3), 507-527.

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華語二語者的部件覺知之比較研究：漢字圈 vs.非漢字圈

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摘要

本研究旨在探討以中文為第二語言的漢字圈與非漢字圈學習者於漢字部件覺識上的比較。透過三項理解測驗（漢字字形辨識測驗、漢字字義判斷測驗及語義提示功能測驗)來測試 40 位受試者是否具備漢字部件的隱性知識及其運用該知識判斷符合結構規則的漢字及提取不熟悉字詞的字義。

研究發現，所有實驗組均在不符合部件位置的非漢字判別上辨識率最高，此結果顯示出所有的受試者均擁有部件位置規則的覺識。此外，亦發現受試者在提取字義的表現取決於漢字的透明度。再者，語境的加入有助於受試者提取漢字字義，大部分受試者在句子脈絡中的整體表現均優於字詞脈絡，此效應對非漢字圈中低級受試者的表現影響尤為顯著。

關鍵詞：第二語言習得、漢字識別、意符覺識、中文

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