The Keyimage Method of Learning Sound-Symbol Correspondences: A Case Study of Learning Written Khmer

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Abstract

I documented my strategies for learning sound-symbol correspondences during a Khmer course. I used a mnemonic strategy that I call the keyimage method. In this method, a character evokes an image (the keyimage), which evokes the corresponding sound. For example, the keyimage for the character ខ could be a swan with its head tucked in. This evokes the sound "kaw" that a swan makes, which sounds similar to the Khmer sound corresponding to ខ. The method has some similarities to the keyword method. Considering the results of keyword studies, I hypothesize that the keyimage method is more effective than rote learning and that peer-generated keyimages are more effective than researcher- or teacher-generated keyimages, which are more effective than learner-generated ones.

In Dr. Andrew Cohen's plenary presentation at the Hawaii TESOL 2007 conference, he mentioned that more case studies are needed on learning strategies (LSs). One reason to study LSs is that what learners do with input to produce output is unclear, and knowing what strategies learners use may help us understand that process (Dornyei, 2005, p. 170). Hopefully, we can use that knowledge to improve language learning, perhaps by teaching learners to use the strategies that we find. With that in mind, I have examined the LSs that I used in studying Khmer as a foreign language, focusing on learning the syllabic alphabet.

Learning Strategy Research

Second language LSs have been studied for more than 30 years (e.g., Atkinson, 1975; Dornyei, 2005; Ho, 1984; Sanaoui, 1995). Researchers have often looked at the effects of using particular LSs, such as the keyword method (e.g., Ho, 1984; Rodriguez & Sadoski, 2000; van Hell & Mahn, 1997; Wang et al., 1992), and they have asked learners what strategies they use (e.g., Chamot & El-Dinary, 1999; Cohen & Aphek, 1978; Fan, 2003; Kojic-Sabo & Lightbrown, 1999; Sanaoui, 1995). An impressive body of research has focused on vocabulary learning (e.g., Cohen & Aphek, 1980; Fan, 2003; Kojic-Sabo & Lightbrown, 1999; Rodriguez & Sadoski, 2000; Sanaoui, 1995), although none have used words from Khmer or any other Southeast Asian language.

Some studies have looked at the learning of non-Roman characters such as Chinese and Japanese kanji (e.g., Ho, 1984; Kuwabara, 2000; Lu, 1999; Wang & Thomas, 1992). These studies generally found that mnemonic devices are effective, at least for short-term recall of character meanings. While such research may shed some light on the problem of learning a semi-syllabic writing system like Khmer, Chinese characters are very different from Khmer characters in three important ways. First, a Chinese character represents both meaning and sound, while a Khmer character represents a sound only[1]. The studies cited above focused on learner recall of meanings rather than sounds. Second, Khmer characters tend to be "simpler" than Chinese characters; that is, they require fewer lines to construct. These differences indicate that the results of these studies of learning Chinese characters may not generalize to learning the Khmer writing system.

To my knowledge, only one study has focused on using mnemonics to learn a non-Roman alphabet (Gruneberg & Sykes, 1996), in this case, the Russian alphabet. The results showed that participants who were given a mnemonic method to learn the alphabet performed significantly better on a posttest than did participants who read the letters and their equivalent sounds only. However, some key

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1 The Khmer numerals are an exception to this rule, but are outside the scope of this discussion.

differences between Russian and Khmer again prevent direct generalization. First, the mnemonics used by Gruneberg and Sykes relied heavily on the similarities between the Russian and Roman alphabets. In my opinion, the Khmer characters and the Roman alphabet have very few such correspondences. (To make your own comparison with a subset of the Khmer characters, see the appendix.) Second, because Khmer uses a semi-syllabic writing system, consonant-vowel combination sounds must be learned, rather than consonant sounds only.

I have found no research on strategies for learning syllabaries (such as Japanese hiragana) or semi-syllabic writing systems like Khmer.

In sum, LSs have been extensively studied, and the learning of non-Roman characters has also been researched, but to a lesser degree. However, research is completely lacking on strategies used to learn Southeast Asian writing systems in general and that of Khmer in particular.

This paper is organized as follows. First is a description of the Khmer class I took, followed by a description of the types of data I collected. Next is a brief overview of written Khmer and an analysis of one of my most prominent LSs (the keyimage method). This LS is discussed in comparison with the keyword method and followed by an explanation of how to generate keyimages. I then provide background on myself as a language learner and conclude by suggesting future research topics.

Khmer Class

In the 2007 spring semester, I enrolled in CAM 105, Web-based reading and writing for beginners, at the University of Hawaii. This course was completely online, so the students did not meet in a classroom. Instead, the teacher posted assignments to the course website, and the students posted their responses. In general, a group of assignments was posted at the beginning of each week, and the students were expected to complete them by the end of the week. Here is an example of an assignment titled "Sound matching/Writing in Chart: Matching Sound/Symbol (High & Low Register) Consosnants [*sic*]," posted by the teacher for the second week of class:

2007-01-21 15:55:00.0
1. Match the sound with the high register consonants:
2. Write them up accordingly in the empty cells.

1 2 3 4 5 6 7 8 9 10 11 12

ក	ខ		ឃ	ង
ច		ជ	ឈ	
ដ	ឋ	ឌ	ណ	
	ថ		ធ	
	ផ	ព	ភ	
	រ	ល	វ	
	ហ		អ	

To copy this table into your respond box, (1) highlight it, (2) right click, (3) and paste it in your response box.

This post was modified by on 2007-01-21 15:56:00.0.

Figure 1. Example assignment.

An audio recording of the missing characters accompanied the written part of the assignment. My (100% correct) response was as follows:

2007-01-22 22:31:00.0

ក	ខ	2	ឃ	ង
ច	4	ជ	ឈ	1
ដ	ប	ឌ	ញ	7
12	ថ	5	ធ	3
11	ផ	ព	ភ	6
10	រ	ល	វ	
8	ហ	9	អ	

Figure 2. Example assignment response.

This example assignment shows that students needed to be able to view Khmer characters in their Web browsers and listen to audio clips. Many assignments required the students to type Khmer characters or words, then record themselves saying them.

Data Types

Diary

Many researchers in second language acquisition have analyzed diary data for varied purposes. Perhaps best known is Schmidt and Frota's (1986) study of Schmidt's learning of Portuguese as a second language. This study generated and supported several hypotheses, including that of noticing being required for language acquisition. Jones (1994) reported on the process of his self-study of Hungarian as a foreign language, including his learning strategies and motivational factors. Focusing on learner identity, Kinginger (2004) used diary data, among other sources, in her study of Alice's expe-

riences learning French. Other L2 diary studies have focused on affective variables, including those of Schumann and Schumann (1977, as cited in Schumann, 1997, pp. 103–108).

Following this tradition of L2 research, I kept a diary of my learning while enrolled in CAM 105. When I began, I did not have a clear idea of what I should focus on, so I followed the recommendations of Bailey and Ochsner (1983): "The diarist should systematically record events, details, and feelings about the current language experience in a confidential and candid diary" (p. 189). I decided that I wanted to electronically keep my diary so that it would be easier to write and excerpt from later, and I used LiveJournal™ (www.livejournal.com), a free online blog (web log) service, for this purpose.

Think Aloud

Cohen (1987) suggested that researchers could investigate "the trial-and-error process of self-generated associations, in an effort to learn more concerning efficient ways of generating such associations" (p. 58). With this in mind, I recorded myself "thinking aloud" as I initially attempted to learn the 13 independent vowel symbols, using the CAM 105 course textbook and a computer flashcard program, MemoryLifter™ 2.0 (free to download from www.memorylifter.com).

Course Website

Usage data was automatically collected by the course website, and the teacher was kind enough to send it to me upon my request. The data show that between January 5 and May 11, 2007, I logged into the site 207 times and spent a total of 45 hours and 44 minutes. The average time I spent per log-in was 13 minutes, which seems rather short. I attribute this to the fact that I often logged in to check whether anything new had been posted, then immediately logged off if I found nothing new.

Written Khmer

Khmer, also called Cambodian, is the official language of Cambodia (Cambodia, 2007). It uses a writing system that can be

called semi-alphabetic or semi-syllabic (Sak-Humphry, 2005, p. 3). To read and write Khmer, the sound-symbol correspondences must be learned. Khmer has 33 independent and 31 dependent consonant symbols, 13 independent and 16 dependent vowel symbols, and nine diacritics (Sak-Humphry, 2005, p. 3). As with any natural language, the sound-symbol correspondences are not always straightforward. For example, each of the dependent consonant symbols has a different sound according to the register (high or low) of the independent consonant to which it is attached (Sak-Humphry, 2005, p. 55).

Khmer characters look similar to Thai characters. Both are members of the Indic script family (Sak-Humphry, 2005, p. 3).

Keyimage Mnemonic

When I examined my diary and think-aloud transcript for strategy data, I found that I often used mnemonics to learn sound-symbol correspondences. According to Nyikos (1985), "A mnemonic device is any technique or system to improve or aid the memory by use of formulas." This is a rather wide definition because almost anything could be believed to improve the memory. Cohen (1987) gave a slightly more focused definition of mnemonic devices as "techniques for converting material to be learned into a form that makes it easier to learn and remember" (p. 43). These definitions fit such devices as the phrase "never eat shredded wheat" for remembering the order of the cardinal directions (where the "n" in "never" represents "north," the "e" in "eat" represents "east," etc.) or the rhyme "30 days hath September" for remembering the numbers of days in each month. However, my definition of a mnemonic includes the idea that a learning target is associated with something that is easy to remember, which is true (at least for me!) of both "never eat shredded wheat" and "30 days hath September." To give an example for Khmer, during the think-aloud session, I tried to learn the character ◌ៃ, which corresponds to a sound like "ai." At one point, I made the following observation: "I see a kind a funny face here, it's almost like a Bart Simpson in profile. Spiky head, and one eye, and big ol' buck teeth, stickin out at the bottom." This image is easy to remember because the image resembles the shape of the character. Later in the session, I made an association between this image and the sound: "Then, ah,

Bart Simpson. What is the sound? Ai. He says ay carumba, doesn't he. Ai, ay carumba. Okay."

For the Khmer characters, as in the above example, my mnemonics generally relied on the shape of the character evoking an image, which evoked the sound of the character. In analogy to the keyword method (described below), I call this the "keyimage method." Here are some more examples.

> Dec. 28th, 2006 08:34 am
> Four more characters
>
> I spent quite a bit longer learning four new characters today, maybe over an hour. It took longer because I also reviewed the four from yesterday and mixed them together. I hope that I can learn them all solidly this way by repeating and reviewing.
>
> I've started making up little stories about the characters. Today, I learned ឍ ឋ ឌ ឍ. ឋ sounds to me like "jaw", so I envision it as a jaw with a cleft chin. Then ឌ is a more complicated version of that, with an extra loop, so it becomes a more forceful sound, chaw. I also think of the teacher, but I don't know if that is really the character in her name. ឍ is the first character I've learned with a curlicue on top, so it looks fancy. It sounds to me like "Joe", so I think of a fancy guy named Joe.
>
> When I learned Japanese hiragana, there were little stories that seemed to be pretty standard to go with each character. They were extremely helpful when I was learning them, and I still remember many of them now. That's why I'm trying to do the same thing with the Khmer characters. Some of the hiragana stories were quite lame, too, the same as my Khmer stories are turning out to be--but that usually didn't matter as long as I could make the association. I wonder if someone hasn't already thought of something like this--something that children use to learn the characters. I'm not sure, but I think that might be why the stories are so well-known in Japanese language learning--because Japanese children use them. May-

> be not, though. I can't recall any of my Japanese teachers in Japan talking about them. I was well beyond that point then, though.
>
> The Khmer characters are rather pretty and interesting to me. I will probably spend another 30 minutes or so reviewing my eight later today.

Notice that it was my previous experience learning Japanese that prompted me to develop these mnemonics. Although the strategy of using mnemonics was not taught in my Japanese classes, I was explicitly given the mnemonics to be used. The major difference between my Japanese and Khmer character learning experiences is thus the creator of the mnemonics: someone else for the Japanese characters and myself for the Khmer characters. In general, does it matter who creates them? Clearly, it does. At the very least, we know that the time investment on the learner's part is less for a provided mnemonic. Assuming that a given mnemonic makes sense to the learner, he or she can more quickly use one that is provided than develop one. Studies of the keyword method give us some insight into other differences between learner-generated and provided mnemonics, so I will describe the method, compare it to my keyimage method, and then explain the insights provided by the previous studies.

Keyword method

A keyword is an English word (i.e., a word in the native language of the learner) that sounds similar to a target language word (Atkinson, 1975). Atkinson explained the method as follows:

> The keyword method divides vocabulary learning into two stages. The first stage requires the subject to associate the spoken foreign word with the keyword, an association that is formed quickly because of acoustic similarity. The second stage requires the subject to form a mental image of the keyword 'interacting' with the English translation; this stage is comparable to a paired-associate procedure involving the learning of unrelated English words" (p. 821).

As an example, Atkinson gave the Spanish word "pato," which means "duck" (the animal). The keyword suggested was the word "pot," and for the interaction, the learner could imagine a duck wearing a pot on its head.

To summarize, in the keyword method, the sound of a target word is associated with the sound of an English word, then the image of the English word is visualized interacting with an image of the meaning of the target word. In the keyimage method, if we generalize from the mnemonics described in the diary entry and "Bart Simpson" example above, a target character is first associated with an image, then the image is associated with a sound.

Clearly, the keyword method differs from the keyimage method. In fact, one is almost the inverse of the other in that the sound precedes the image in the keyword method, whereas the image comes first in the keyimage method. A second difference is that Atkinson defines the keyword method only for learning foreign language vocabulary, whereas the keyimage method is tailored to learning sound-symbol correspondences. Third, the keyimage method does not require visualizing any interaction. The keyword and keyimage methods are similar, however, in that both have two steps and rely on sounds being associated with images. Therefore, studies of the keyword method give us a starting point for hypothesizing about the keyimage method.

Effectiveness of the keyword method

As Hogben and Lawson (1997) stated, "The keyword method is well established as a useful procedure for the acquisition of foreign language vocabulary" (p. 378). Starting with Atkinson's (1975) study, the keyword method has generally been shown to be more effective than rote learning techniques. Although Atkinson hypothesized that the method would be more effective for beginning learners than for more experienced ones, subsequent research has found that it is effective not only for beginners (e.g., Sagarra & Alba, 2006), but for experienced learners (e.g., Lawson & Hogben, 1998) and both good and poor learners (e.g., Pressley et al., 1980).

Of course, not all research on the keyword method has supported its effectiveness. Campos et al. (2003) found that the rote method was more effective than the keyword method for both adoles-

cents and adults in a classroom setting. In contrast with the results that the keyword method is effective for learners of all levels of experience with language learning, van Hell and Mahn (1997) found that rote learning was more effective than the keyword method for experienced L2 learners, while for inexperienced learners, the rote and keyword methods were equally effective. Several studies (e.g., Wang et al., 1992; Wieczynski & Blick, 1996) have shown that learners using the keyword method have greater long-term forgetting rates than learners using a rote method. In response to this issue, Wang and Thomas (1995) performed a series of experiments that showed that without practice, forgetting rates were greater for keyword learners than for rote learners, but with repetition, the long-term retention was improved.

Despite some problems, using the keyword method is generally supported by research. (For a concise argument, see Kasper, 1993.) I predict that similar results can be obtained for the keyimage method.

Cognitive pathway of the keyword method

Initially, a learner associates a character with a keyimage and that keyimage with a sound. After enough practice, can the learner directly access the sound from the character, or must the keyimage always mediate, at least subconsciously? Crutcher and Ericsson (2000) tested the keyword method and found that after extensive practice, keywords no longer consciously mediated between L2 vocabulary words and their translations, based on latency measurements (i.e., the time it takes to recall the translation of an L2 word) and verbal reports. However, they argued that while the keywords did not need to be accessed consciously, the same mental pathway involving the keyword as a mediator was still being followed. On the other hand, Rickard and Bajic (2003) argued for direct access, based on Crutcher and Ericsson's results and their own keyword experiment (which did not involve L2 learning). These opposing opinions show that for the keyword method, the question of whether direct access can occur is unresolved. I think that we can reasonably assume that similar testing of the keyimage method would lead to similarly inconclusive results.

Importance of the creator of keywords

What do studies of the keyword method tell us about the importance of who generates the keywords? On the issue of student time investment, Campos et al. (2004a) said that one reason to provide keywords to students is that the time necessary to produce a keyword is time lost from language learning.

Which keywords are more effective, provided or learner-generated? Atkinson (1975) found that students instructed in the keyword method did significantly better on a posttest of Russian vocabulary on words for which they were provided the keywords than one on words for which they were told to generate their own. On the other hand, in a similar experiment using Latin words, Pressley et al. (1980) found no difference between having students generate keywords and the researchers providing them with keywords. They therefore recommended not providing students with keywords, but they limited this to cases where keywords are relatively easy to generate. The problem, then, is knowing when a keyword is easy to generate, and Atkinson can provide at least a partial answer. He found that when students were given an opportunity to generate their own keywords and an option to be provided with one, they asked to be provided with one 89% of the time. Although we can imagine that the students may have been overly quick to take the easy option to be provided with a keyword, rather than go to the trouble of generating their own, 11% of the time, a keyword or some other way of learning the target word seems to have quickly come to mind. This indicates that most of the time, a keyword is not completely obvious to learners and that providing one would save them time.

As Campos et al. (2004a) stated, an argument against providing keywords is that researchers and teachers may not encode meaning in the same way as their participants or learners. The results of their studies indicate that keywords generated by peers of learners may be even better than experimenter-provided keywords (Campos et al., 2004a, 2004b). In one of these studies (2004a), L1-Spanish adolescents (ages 12 to 15) were found to have significantly better immediate recall of the Spanish translations of Latin vocabulary words when they used peer-generated keywords than when they used their own habitual methods. For words designated "low-image-value," the group using peer-generated keywords had significantly better imme-

diate recall than learners using either their habitual methods or researcher-generated keywords. In a similar study (Campos et al., 2004b), L1-Spanish children learning Latin words using experimenter-provided keywords had significantly better results than those using a rote method on long (32-word) lists when only words with high image vividness were considered. Children who were provided peer-generated keywords performed significantly better on immediate and delayed posttests than either the group provided with the experimenter-generated keywords or the rote learners.

The above results on who should generate keywords generally indicate that keywords generated by peers of learners are expected to be the most effective. Therefore, I hypothesize that the keyimage method would be most effective for learners using peer-generated keyimages. More specifically, I propose that other learners of Khmer could benefit from being provided with my keyimages. Obviously, not all learners of Khmer are my peers. The brief description of my language learning background (below) will help determine my peer group. However, perhaps a more important point to consider than exactly who my peers are is which of my keyimages are likely to be useful to other learners. Some of my keyimages, for example, depend on a knowledge of Japanese and therefore would be useful only to a particular subset of learners. Despite the limited applicability of some of my keyimages, in the hope that some of them will be useful, I have provided some examples in the appendix.

Keyimage Generation

My keyimages will not necessarily be useful to all other learners, but knowing how I generated them may be. Given the method, anyone can generate his or her own keyimages, which may allow more effective character learning than learners' habitual methods. The transcript of me thinking aloud while studying the independent vowels for the first time can perhaps provide some insight into how keyimages are generated. Here is an excerpt. (The numbers were added later for clarity.)

Transcript, March 14, 2007, approximately 1:00 to 2:00 p.m. …

1. [ឰ] Okay, let's go to the next one. Ah, this one is uhi. Looks like daw, with kind of a lo, next to, wrapping around it. Uhi, why is this uhi? Hmm. Hmm. Uhi. I guess I'm just kind of staring at it. Not seeing what I need to see right now. Uhi. Maybe I'll come back to this one.

2. [ឧ] Okay, the next one. This is, looks like kaw with a little serif on it, and then uh, sound, I better check what the sound is exactly. I'll make sure I got the last one right. Uhi. Uhi, okay. O. O. O. O. Okay. The short o sound. O. Okay. Like backwards S with a foot on it. O. O. Kinda looks like a person kneeling with their foot curled around and their, their head bent over. What does that have to do with o? They're paying homage to something. O. Homage.

3. [ឩ] Okay, next. This one is very similar but with an added line to it. And check pronunciation. Oo. Oo. This is the longer oo sound. Okay, add the extra line and make it a longer sound. Makes sense.

4. [ឫ] Okay. Next one. Looks like bo with a little squiggle under it. Ah, the sound is gonna be u, ru, ru, okay, this has got an r sound with it. How in the heck does that make it a vowel? Alright, well, anyway. Ru, ru, well, it kinda looks like a face. The little squiggle is a, a smiling mouth, and the little tops of it are the eyes, and it's got a big nose. Looks like he's eating something and smiling about it. Maybe it's rude to eat in front of people. That's why he's all giggly. Ru is for rude. Okay.

5. [ឬ] This one is similar, very similar, but it's got, there's a little tongue sticking out of the mouth now. I think it's gonna be ruu. Ruu. Yep, okay. So, this one is even ruuder. Tongue stickin' out.

…

At the beginning of this excerpt, part 1 is a typical unsuccessful attempt to generate a keyimage. While I looked at the character, I found the sound that it made, tried to relate it to characters that I already knew, and no keyimage came to mind. The rest of the excerpt, parts 2–5, shows some successful attempts to generate keyimages. Parts 2 and 4 are typical of one way of generating keyimages, which is shown schematically on the right side of Figure 3. The beginning of the procedure is the same as an unsuccessful attempt: while looking at a character, I try to relate its appearance to known characters and find the sound that it makes. (Sometimes the order of these steps is reversed, as in part 4.) At this point in the unsuccessful attempt, I continued to stare at the character with no further progress, but in parts 2 and 4, I looked at the character as a picture, thus generating the keyimage itself, and related the sound of the character to the keyimage using a sentence or story.

What about the two other successful attempts, in parts 3 and 5? These two attempts are also typical, but of a slightly different way of using keyimages, shown schematically on the left side of Figure 3. This use of keyimages is the reason for checking whether the target character looks similar to known characters. In parts 3 and 5, while looking at a target character (call it X), I tried to relate its appearance to known characters and found that it was extremely similar to one of them (call it Y). I noted the differences in the appearances of X and Y. I then found the sounds of X and Y and noted the differences between them. Finally, I tried to relate the differences in the appearances of X and Y to the differences in their sounds. In this way, the same keyimage that was generated for Y can be used for X, while avoiding confusion between X and Y.

Language Learning Background

I hope to make my learning experience as real and believable to the reader as possible. As Bailey and Ochsner (1983) said, "Rather than the diarist's honesty, what matters is the author's ability to make himself [*sic*] believable as a participant in second language events" (p. 192). Bailey and Ochsner go on to say that one factor in believability is the background information provided and the language learn-

ing history in particular. Therefore, following the precedent set by Schmidt (1986), I include below my language learning history in brief, with languages listed in descending order of proficiency.

Japanese

I studied Japanese for 2 years at a Midwestern university and about 3 years working as an English teacher in Tokyo. While in Tokyo, I attended Japanese language circles for about 2 to 6 hours each week. In these circles, I was matched with other learners of Japanese and native speakers, generally for free conversation, but sometimes for a more structured lesson. I completed two graduate courses (taught in English) in teaching Japanese as a foreign language while still in Tokyo. About 6 months after leaving Japan, I took a written placement exam for University of Hawaii courses and placed beyond the 400 level.

French

I studied French for 3 years in high school. I placed into second-year French at my undergraduate university and completed the second year before studying abroad in France for 2 months the following summer. While in France, I completed three 300-level courses, then completed one more the following fall semester.

Khmer

Before beginning the online course, I had traveled in Cambodia for about 5 days. During that time, I spoke English exclusively and learned only the Khmer word for "hill." After coming to Hawaii, I picked up one phrase ("thank you") from students in the Cambodian club. Beyond that, my knowledge of Khmer before beginning the course was zero.

Suggestions for Future Research

While I hope that my keyimage method and my specific keyimages will prove useful to other learners and teachers, the main results of this case study are the questions that it raises. I summarize below the hypotheses that I have formed based upon the results of the keyword studies. I then address three further questions that could

be studied, briefly mention previous research relevant to them, and predict what will be found for the keyimage method.

Summary of hypotheses mentioned above

First, I predict that the keyimage method will prove more effective than rote learning. Second, opinions will differ on the cognitive pathway used in retrieval of sounds from their associated characters when the keyimage method is used to initially learn the correspondence. Third, using peer-generated keyimages will be more effective than using researcher-generated ones, which will be more effective than using learner-generated ones, which will be more effective than learners' habitual methods.

Further questions for research

What kinds of characters can the keyimage method be most effectively used to learn? I did not use the keyimage method equally when learning the different types of Khmer characters. For example, I used it extensively for the independent consonants and vowels, but much less so for the dependent vowels. One major difference between the independent characters and the dependent vowels is how the former generally look more "complex" than the latter. Therefore, I hypothesize that the keyimage method is best suited to the learning of characters that look complex enough to suggest a keyimage. Clearly, to test this hypothesis, the idea of a character being complex will have to be defined. A few possible definitions are the number of strokes needed to write a character, the number of disconnected parts that make up the character, or some combination thereof.

Can the keyimage method be extended to the study of non-Khmer characters? I firmly believe that it can. I used a very similar method when I learned the two Japanese syllabaries (hiragana and katakana) and some kanji. I hypothesize that it will also be useful for learning other syllabaries (such as Native American writing systems, including Cherokee), semi-syllabic writing systems (such as Thai), alphabets (such as Cyrillic or Korean), abjabs (such as Arabic), etc. However, from personal experience learning Japanese, I do not think that it will prove as useful for most kanji because they are too complex to suggest a keyimage. I therefore predict that the usefulness of

the keyimage method is limited to characters within a certain range of complexity.

Can the keyimage method be effectively used to learn to write characters? When I first began CAM 105, I practiced writing the characters by hand, but as the following excerpt shows, I later gave it up.

> Mar. 11th, 2007 10:44 pm
> learning to read
> ...
> All this ranting reminds me that I have been a bit lax in my studying in that I haven't been practicing the physical writing of the characters. In this online venue, it doesn't seem necessary, although the teacher occasionally reminds us to practice it. But seeing as I have so much else to concentrate on, I think I'm going to continue to let it slide. I did the same thing with kanji after a while--I stopped trying to write it and was satisfied with only reading it. But this is much more fundamental than kanji, I suppose. Khmer can't be written without these characters, while I could get away with writing only in hiragana and katakana in Japanese when I couldn't type. I imagine that in Cambodia, the situations where I would need to physically write with a pen and paper are much more frequent than they are here or in Japan. So, not needing the writing is an excuse, and a poor one at that.
> ...

Thus, my data cannot provide much insight into this question. In my experience, keyimages help me to remember the general shape of a Japanese or Khmer character, but not always the details. Therefore, I predict that keyimages will be found useful for learning to write characters, but only if keyimages are used in combination with repeated writing practice.

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Appendix

Example Keyimages: Independent Consonants

In the table below, the "character" column shows the Khmer independent consonants in the order that they are found in Khmer dictionaries. The "sound" column contains my own romanizations, which are non-standard. The "keyimage" column generally contains explanations of my keyimages, but where noted, contains my comments. The keyimages and comments are quoted from a diary entry made on January 5, 2007 at 11:50 a.m., except where noted.

Character	Sound	Keyimage
ក	Gaw	[Comment] This is the first one, so somehow it's easy to remember. It looks kind of like a staple with a fuzzy top. I first learned that the sound was "kaw," but it actually sounds more like "gaw" to me.
ខ	Kaw	This is a swan with its head tucked in saying "kaw!"
គ	Go	This is a tunnel with a person "going" through it. [Comment] It looks similar to "gaw."
ឃ	Ko	The two top curves in the middle and at the right end look like backward Japanese katakana "ko's" (コ).
ង	Gno	[Comment] I think I've learned this one through repetition more than anything. It's got some crazy curves at the top that you don't see on any other character, and the sound is also unusual to me.
ច	Jaw	The bottom part is a jaw with a cleft chin.
ឆ	Chaw	This is similar to "jaw," but a little fancier. I guess that gives it a feminine appearance. I don't know if it's the correct sound, but I think of [someone]'s name.

ជ	Jo	This doesn't make much sense, but for some reason, I think of this guy named Joe that I went to high school with. He wasn't especially fancy, but I've somehow associated the curliness of the top of the character with him.
ឈ	Cho	This character is really long, so the Japanese word "cho," which means something like "very" or "super," describes it well.
ញ	Nyo	The bottom part of this character looks like a tilde, which can be called "nyoro" in Japanese.
ដ	(G)daw	The top part is dog (dawg) doo.
ឋ	Taw	The right part of the character keeps going up and up like a tower.
ឌ	Do	I say "doh!" because a snake fell in love with me (see the heart?).
ឍ	To	The left top part of this character looks like a toe crotch, as you would see in a woman's dress shoe.
ណ	Naw	The character is two teeth ready to gnaw on something.
ត	Daw	The round part is the sun coming up through a window at dawn.
ថ	Taw	This is a steaming cup of coffee, which symbolizes "cawfee tawlk." [I explained in an entry on December 31, 2006 at 4:28 p.m.: "First, ថ is a cup of coffee with a little handle and steam rising off it, and it sounds like 'taw.' So I remember 'coffee talk' and the way Mike Myers said it." This is a reference to a Saturday Night Live sketch.]
ទ	Do	The loop in the middle of the character reminds me that it has an "o" sound. The large curve at the top is the loop of a lowercase "d."

ធ	To	This is a house or a slice of bread being towed down the road by the loop. It sounds just like ឈ to me.
ន	No	I said "no!" to the snake who loves me and stepped on his tail.
ប	Baw	Anemones at the bawtom of the ocean.
ផ	Paw	This is Pa, with his knees bent, head at right, reclining and smoking. The curl at the top is the smoke.
ព	Bo	This is a bow for a package.
ភ	Po	This is a steaming pot of water ready to po' (pour).
ម	Mo	This is a cow with horns. "Mo" is the sound a cow makes in Japanese.
យ	(G)yo	This is a yoke for oxen.
រ	Ro	The bottom part is an upside-down Greek letter "rho."
ល	Lo	This is a person in a yoga pose, with the head at the right and feet at the left. The butt and head are high in the air, but the chest is down low.
វ	Vo	This is like "ro," so it has the "o" sound, but it has an added "v"ector going up.
ស	Saw	This is the same person doing yoga, but now there is an eye on the back, so someone saw it.
ហ	Haw	This is the teeth of "naw," but with the first one knocked out. People with teeth missing are hillbillies like on "Hee Haw."

ꦮ	Law	The right part of this character is really laaaawng.
ꦄ	Aw	This is two birds tied together and saying "aw aw."

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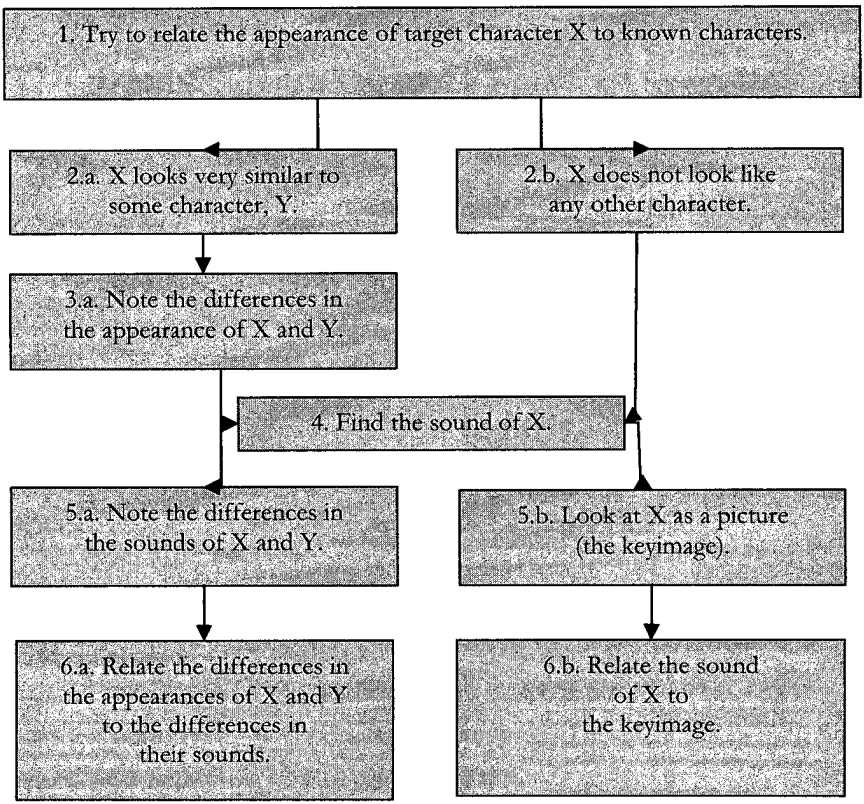

Figure 3. Procedure for generating keyimages