ABSTRACT: Chinese Flashcards on Computer is a system for computer-assisted practice of Chinese vocabulary. The main goal of the system is to help students improve their association between the sound of a Chinese word or phrase and its graphic shape, as written in Chinese characters. A secondary goal is to get the student to associate meaning through typing the correct pronunciation in standard pinyin romanization and an acceptable English equivalent. The computer responds to wrong and right answers. The system has many special features such as an extensive and flexible vocabulary of Chinese characters, diacritical marks, and a digitized voice stored on the disk. There are also plans for future improvements to the system.

KEYWORDS: Chinese Flashcards, CCG (Chinese Character Generator) boards, Victor 9000, diacritical marks, digitized voice, vocabulary

Chinese Flashcards on Computer is a system for computer-assisted practice of Chinese vocabulary, which has been in use in the Duke University language labs since August 1984 by students enrolled in first- and second-year Chinese courses. It uses Victor 9000 microcomputers equipped with Chinese Character (CCG) boards manufactured by Eastern Computers, Inc. of Virginia Beach, Virginia, and a built-in digitized sound recording and playback capability. The main goal of vocabulary practice using this system is to help the student more easily associate the sound of a Chinese word or phrase with its graphic shape, as written in Chinese characters. A secondary goal is the common flashcard function of associating meaning. The student works to accomplish this by first typing, in standard pinyin romanization, the correct pronunciation of a word or phrase he or she sees on the screen. Tone marks are added over the main vowel.
in each syllable by typing them after the vowels they belong over. If the pinyin pronunciation is correct, the computer responds with a written "Good!" in Chinese on the screen and automatically pronounces the displayed word or phrase. Otherwise, the computer responds with a written "Wrong!" and asks the student to listen to the word pronounced and try again. After a specified number of unsuccessful tries, the computer shows the student an acceptable answer. At any time before or after typing, the student may press a function key to hear the computer pronounce the word correctly, as an aid in typing the pinyin. In a similar fashion, for each word or phrase the student is also asked to type an acceptable English equivalent. If there is an example sentence displayed on the screen, he may also hear that spoken by pressing another function key.

We have keyed to the texts used in our own first- and second-year Chinese courses, including the two most widely used Chinese texts in the world, John DeFrancis's *Beginning Chinese* and Beijing Language Institute's *Elementary Chinese Readers*, and the supplementary readers *Lady in the Painting* and *Strange Stories from a Chinese Studio*.

A data disk contains one or more lessons, each with its own vocabulary dataset and associated voice and key files. Depending on the text and lesson, there can be from 20 to 60 lexical items per lesson. Each entry for a lexical item consists of: 1) the alphabetic codes necessary for the CCG hardware to generate on the screen the required Chinese characters in the word or phrase and example sentence, in both simple and complex style (example sentences in the current implementation are displayed only in the simple style; 2) up to two acceptable pinyin pronunciations; 3) up to three acceptable English equivalents; and one or two syntactic classes to which the word belongs (not currently used in Chinese Flashcards, but available for future applications). Note that the printed datasets are not intended for student use, but only to facilitate editing by the staff. The student is, however, provided with a printed "Comprehensive Vocabulary List" for each lesson in his text, consisting of the Chinese lexical items only, written in characters in both styles. He can use this for making notes as he uses Chinese Flashcards. Also, since most Chinese texts are published in only one character style, the lists help the student to consolidate his knowledge of the relationship between styles.
Portability

The program for Chinese Flashcards and its supporting programs were written in generic Microsoft BASIC, and now run in a compiled version, incorporating the Victor 9000's special "voice kernel" subroutine for interfacing with the digital-to-analog converter, called a CODEC (coder-decoder). With the exception of the modified character set and keyboard, and the CODEC voice routines, the programs would run with little modification on other microcomputer equipment equipped with similar CCG boards. (Different systems of Chinese character display would require minor adjustments in the program.) However, since the tonal typing and voice capabilities are fundamental in Chinese Flashcards, it would be desirable to achieve these features on other micros to which the program was transported. Special programs and plug-in cards are available, for example, for the IBM-PC, which enables it to display alternative character sets with special keyboard arrangements and to play digitized voice files. One of our projects at Duke is to make Chinese Flashcards available for the IBM PC and, perhaps, other microcomputer equipment. Chinese Flashcards and its supporting programs are available at cost.

Special Features

Some of the special features of Chinese Flashcards, which distinguish it from other flashcard programs, are described in more detail below:

1. The Extensive and Flexible Display of Chinese Characters

As many as 30,000 different Chinese characters may be displayed on the computer screen in either simple-style characters, as used in the People’s Republic of China and Singapore, or complex-style characters, as used in Taiwan and Hong Kong and in traditional texts, or in both styles. The student selects either simple-style or complex-style characters as the main style to display and practice, but may also display the alternate style for each word as he wishes, by pressing a function key. This feature permits a student studying with a typical textbook written in only one style to master the other style on his own, either while progressing through the text for the first time, or in review. In fact, a preliminary conclusion drawn from student use of Chinese Flashcards for review is that there are a number of such ways in which the system is effective in advanced language maintenance, particularly for students who have not studied the language for a year or more.
Methods of keyboard input of Chinese characters are still primitive, and it would be unreasonable to expect the student to master an encoding system, in addition to the already cumbersome Chinese script. Hence the program has been formulated so as to allow the student to respond actively, but alphabetically, to Chinese characters displayed for him on the screen. The Chinese instructional staff handles all character encoding in the process of developing courseware for a particular text or course, using the common system of alphabetic character component codes utilized by Eastern Computers (called variously "Cang Jie," "Chon-ji," or "Dragon").

A separate supporting program, called Chinese Vocabulary Database Manager, is used for data entry, updating and enhancing the vocabulary file, printing of all hard copy of courseware and student record-keeping. Each student automatically creates a new record sheet for himself, if one does not yet exist, the first time he uses Chinese Flashcards. In subsequent uses he is shown which lessons he has worked and the scores he has achieved (e.g., 42 out of 46 correct). The system saves the best performance to date.

2. Naturally Typed and Natural-Looking Tonal and Other Diacritical Marks

The student has the ability to type diacritical marks over the vowels where they belong. The Victor 9000 provides a very accessible system for designing character sets and assigning these characters to particular keys on the keyboard. Our implementation of Chinese Flashcards has made use of this by first designing the necessary symbols in the upper 128 ASCII codes (see printout of character set in attached appendices), then assigning the four tones of Modern Standard Chinese to the first four function keys, and the umlauted ‘u’ to the fifth function key. A tone mark can be placed over a vowel, including the umlauted ‘u,’ by pressing the appropriate function key immediately after the main vowel in a syllable over which it belongs. Thus two keystrokes are required to construct the various combinations of four tone marks with six lower-case and three upper-case vowels. (A total of 29 lower-case and seven upper-case tonally-marked vowels actually occur.) A simple mathematical function during operation of the program, transparent to the user, converts the combination of the unmarked letter key and function key which have been pressed to the correct letter marked for tone.
3. Digitized Voice Stored on Disk and Available for Instant Playback

*Chinese Flashcards* fully utilizes the Victor 9000's ability to reproduce the native speaker's voice, previously digitized by a Voice Editor utility from either microphone or pre-recorded audio tape input, and stored as a voice file, along with its associated key file, on the data disk for a text lesson. Since it is actually recorded human speech, it is identifiably an individual speaker's accent. The price paid for fidelity in sound is in disk space. The digitized voice files are far larger than the ordinary data files. The pronunciation of one word might require 5K bytes of disk space, while an example sentence might take 15-30K. However, the Victor uses variable speed disk drives with a disk capacity of 600K bytes for a single-sided floppy disk or 1.2 megabytes for a double-sided disk, and it handles enormous voice files of 500K bytes or more well, with an access time of at most 1-2 seconds to pronounce a word or example sentence for the first time. After the initial retrieval from the disk, voice is stored in an audio buffer up to its 50K capacity, and response is instantaneous. For example, during the repeated practice of just a few words, in a small loop through the items in a lesson, all voice for both main word entries and example sentences is held in the buffer, and can be accessed instantly by pressing the function keys.

4. Considerable Flexibility in Vocabulary Practice

The *Chinese Flashcards* program always presents vocabulary to the student in random order. He can shuffle and reshuffle his "deck" of flashcards as many times as he wants. He can define a "loop" size, which will be the number of vocabulary items he is presented in succession, before having the opportunity to repeat them again immediately, go on to the next loop, or record his final score and exit from the system.

Plans for Future Enhancements

Some of the enhancements being developed or contemplated for *Chinese Flashcards* are as follows:

1. Error Analysis

Experience in the first five months of student use of the system has made it clear that there are numerous areas of student frustration with the literal-minded computer's rejection of minor typographical errors or sub-standard spellings which standard techniques of mechanical error diagnosis and advice would deal with very effectively. The development of more sophisticated, and
necessarily experimental, techniques of responding to the student answer is a high priority for the next version of Chinese Flashcards. Yet at the same time, we must acknowledge that thorough solutions to the problems ultimately responsible for this student frustration, namely, a combination of inadequate computer literacy and ill-defined orthographic standards for Chinese in pinyin transcription, are beyond the capabilities of Chinese Flashcards to achieve. Improved computer literacy and sensitivity to correct pinyin style are, nevertheless, useful by-products of practice with the system.

2. Experimental Versions for Other Languages

The objective of developing an association between the sound and graphic shape of a word which is typical of Chinese is desirable in numerous other languages in which the writing system does not closely mirror actual pronunciation. Japanese immediately comes to mind as a candidate for a similar system. Students of any alphabetic languages with non-Roman alphabets, such as Russian, Arabic, Hebrew, Greek, and all the South Asian languages, might also be able to use the system to good advantage, especially during the first few months of study. Even language such as French and English, in which the spelling cannot be predicted from the sound, would benefit from such an approach. In the case of French or English, the initial display of any written form could be suppressed, or represented differently. The ESL student of English, for example, could hear a word or phrase pronounced, then be expected to type its correct spelling, with or without also typing a foreign language equivalent.

3. Greater Flexibility and Sophistication Within the Program

Working with a physical deck of flashcards, we have all put to one side the cards for words which we were sure of, and continued to practice those we couldn’t seem to remember. In Chinese Flashcards as well, there needs to be a procedure to keep track of student mistakes, and allow the student to choose to practice again only those words which still give him trouble.

A number of improvements are also planned for the editor program, Chinese Vocabulary Database Manager. First, there will be a menu option for the instructor to request a printed list of vocabulary from lesson to lesson in a text, separated into syntactic classes. This should be a handy tool for the teacher during classroom drill. Second, there will be a menu option to generate review lessons, drawing on vocabulary randomly from an entire text or a group of texts. Third, there will be a menu option for the instructor to change system
parameters, such as the number of wrong answers allowed, or whether or not to suppress entirely a part of the flashcard practice, such as the typing of English equivalents.

**Author's Biodata**

Richard Kunst has taught both Chinese and Japanese at Duke University, where he is presently an Adjunct-Assistant of Chinese. He received his Ph.D. from the University of California at Berkeley in Chinese Language and Literature. His dissertation on *The Book of Changes*, entitled *The Original Yijing: A Test, Transcription, Translation, and Sample Glosses*, included a computer-compiled Chinese character concordance and statistical analyses. His interest in humanities computing began in the 1960s and he has been developing CALI materials for microcomputers since 1982. He is currently working on *The Duke Chinese Typist*, a Chinese word processor especially for students and teachers of Chinese, which runs on an IBM PC or compatible with no special hardware modification beyond 512K and EGA graphics.

**Author's Address**

Richard Kunst  
Asian/Pacific Studies Institute  
21 11 Campus Drive  
Duke University  
Durham, NC 27706