ABSTRACT: Yu-gong Yi Shan is the title of an ancient Chinese fable. Its electronic version discussed in this article, is a prototype of the use of technology “in support of Chinese teaching and learning.” Developed cooperatively by a content expert and an educational technologist, Yu-gong demonstrates how hypermedia can be designed to overcome the linear, static and silent constraints of book technology and provide an integrated, interactive and learner-centered reading environment for students of Chinese.

KEYWORDS: Hypermedia, book technology, multidimensional, interactive and integrated learning environment, learner-centered, active and holistic learning, communicative approach

Instructional Needs

The Technical Constraints of Book Technology
For several centuries, the communication technology of the book has defined what is meant by foreign language education, and its linear, static and silent constraints have long directed the development of many teaching and learning methods. Today, the rise of electronic communication technologies has opened up new possibilities for foreign language educators. New technologies that can create a multidimensional, interactive and integrated learning environment may transform the book-conditioned learning process into a holistic and active learning experience. Its potentials are awaiting educators to explore.

Students’ Lack of Control Over the Instruction
Schank and Jona (1991) argue that “one of the main problems facing education today is students’ lack and control over the instruction they receive.” In the classroom, each student has different needs and ways of learning. Some may learn faster and some slower. Some want to explore more on a subject matter but others do not. A class is seldom so homogeneous that mass instruction is effective for all participants. Teachers often find that it is difficult to adapt instruction to various needs and learning styles.
Thus, there appears to be a need for educators to explore new ways of making instruction more learner-centered and more adaptable to individual differences. This is especially true for learning Chinese as a second language.

The Difficulty of Consulting a Chinese Dictionary
For those who learn Chinese, looking up words in a Chinese dictionary can be very difficult and time-consuming. This is due to the unique nature of the Chinese writing system. Words in Chinese are composed of characters rather than alphabet, and characters themselves are made up of various kinds of strokes. When a student does not know the pronunciation of a character or is not familiar with the radical system, the “easiest” way of looking up a character in a dictionary is to count how many strokes it has. If the count is right, most of the time the student has to go through a long list of characters all carrying the same number of strokes before locating the one sought. The process is often time-consuming and frustrating. Undoubtedly, the plea for a learning tool that can facilitate rapid reference to vocabulary meaning has often been heard in the Chinese classroom. The computer is that tool.

The Electronic Yu-gong

Hypermedia, a further development of hypertext, is a relational way of organizing information into a semantic network. Text, graphics, audio, video, and related information can be integrated into a dynamic document with instantaneous cross referencing. Taking advantage of hyper- and multimedia technology, we are able to overcome the linear, static and silent constraints of printed technology, and to organize explanations of words, pronunciation, character writing, grammar, and comprehension drills into one learning system that enables students to study a language in a more holistic and active manner.

In Yu-gong’s integrated and interactive environment, learners of Chinese can point and click with the mouse at any key Chinese vocabulary and get the dictionary definition, stroke by stroke animated writing demonstration, digitized pronunciation, grammar rules and examples of uses (all at the same time). After finishing the reading, students may self-test their reading comprehension. The test will be scored and students’ mistakes will be recorded for teacher review and remedial consideration.
中国古代有个寓言，叫“愚公移山”。说的是古时候有一位老人，住在华北，名叫愚公。他的家门前边有两座山，又高又大，挡住了他家的出路，

Figure 2. The Reading Environment
On-line Dictionary
Research (Perfetti 1985, Stanovich 1980, Rumelhart 1977) shows that reading is neither a bottom-up nor a top-down process, but rather a parallel process in which the interplay of decoding and comprehension is complementary. However, most Chinese language students, relying upon bottom-up processing, tend to decode the text in a laborious character-by-character fashion. They often pause to look up the literal meaning of vocabulary in a dictionary and fail to utilize their own knowledge or to make top-down prediction. As a result, the slow pace and the frequent interruptions tend to distract students from comprehension as well as to wear out their patience and energy.

Yu-gong addresses this problem by providing an on-line dictionary (figure 3) with Pinyin (a Chinese phonetic system used in mainland China) and English definitions. The electronic dictionary relieves students not only from the labor and frustration of looking up vocabulary in a printed dictionary, but also from the short-term memory constraint. As the decoding operations become easier, more cognitive capacity can be made available for top-down comprehension. The students can improve their reading comprehension by paying more attention to the syntactic and semantic cues of a text. Consequently, the whole reading process can take less time and readers can be less distracted from the reading task at hand.

*Figure 3. The On-line Dictionary*
Digitized Pronunciation
In addition to the on-line dictionary, which facilitates the correspondence of meaning and grapheme in the reading process, the Say feature of Yu-gong is designed to promote another important correspondence. Because of the limitation of silence in book technology, students on their own can get no aural input on vocabulary during a reading process. Without such aural input, it is difficult for them to practice phoneme-grapheme correspondence. However, with only a click on the Say button in Yu-gong, students can get immediate connection between the new words and their corresponding pronunciations. Moreover, they can listen to the digitized speech and practice the phoneme-grapheme correspondence as many times as they want without rewinding and searching on a tape.

Writing Animation
The Write feature is designed with the belief that showing is always more effective than telling. Therefore, we decided to involve students in a learning process that is observational. Instead of having students read printed instruction about the proper way of writing a character, we provide an animated demonstration on the computer screen as seen in figure 4.

Figure 4. The Writing Animation
Students can click to see how a character is written stroke by stroke as many times as they want. The animation power of the computer not only illuminates the pictorial nature of Chinese characters, but also makes character writing more vivid and motivating than what is offered by book technology.

**Further Exploration**

Taking students' individual differences into consideration, the **Study** feature is designed for those who want to explore more on the usage or sources of certain characters. Since the purpose of the program is to enhance students' reading comprehension, relevant and interesting information is provided to facilitate and motivate their reading. Figure 5 illustrates how the Study feature offers essential explanations of syntactic rules or cultural and historical background of a Chinese character. It is worth mentioning that when we give grammar support, we provide not only the syntactic rules but also the specific contexts of their applications. Reading, we believe, is another way to cultivate students' language proficiency. We are more concerned with how students can use the grammar to improve their communicative abilities than with how many rules they have memorized.

![Figure 5. Further Study on China](image)
The Electronic Quiz
When students have finished the reading, they can test their comprehension by taking the on-line quiz. There are no multiple-choice question. The quiz is composed of both factual and cognitively demanding questions that require analysis and synthesis of meaning in the text. Students can type in their answers in English sentences or phrases. The answers are then checked by a key-words matching algorithm. This is a unique feature of Yu-gong’s Quiz because it enables students to actively construct the answers rather than pick one our of several given responses, as seen in figure 6.

![Image of the Electronic Quiz]

Figure 6. The Electronic Quiz

No matter whether students’ responses are right or wrong, the correct answers are always provided as reinforcement. If students’ answers are wrong, Yi-gong will save them to the Report Card for teacher review, as Figure 7 illustrates. Since the program records student mistakes in their original form, teachers can have an understanding of the context in which the mistakes occurred. This kind of contextual information is rarely available from a multiple-choice test.
Individualized Learning
To address the problem of students' lack of control over the instruction, Yu-gong allows learners to individualize their reading process according to their own levels and interests. The reading program enables learners to adopt the "text" to their individual needs by offering them the control of information presentation. For example, students may choose to get the definition of a word and listen to the pronunciation without studying its way of writing or grammar. Or they can probe deeper and have a better understanding of a particular word or usage by exploring the grammar and cultural explanations. They can also listen to its pronunciation or watch the standard way it is written as many times as they want until they master the skills. The computers will never complain or make the students look ignorant as may happen in class.

Creative Teaching
By making available most of the learning resources at once and in one place, Yu-gong not only enhances the effectiveness of students' independent study time, but also frees the time in class from grammar or vocabulary lectures for more communicative and creative activities such as role-play or story telling. While students can check out Yu-gong whenever the language lab opens and pace their study according to their own
schedule and needs, teachers can analyze student mistakes recorded by Yu-gong and recommend or require further practice or instruction if it is necessary.

**Design Specifics**
We have tried to keep the hot links and user interface as simple and well-structured as possible. We believe that ill-structured multisensory input alone would not produce the target learning effectively. Sometimes bells and whistles would only distract. We have confined the links to a maximum of two levels and avoid any cross-links so that learners who like to explore will not get lost and be distracted from the reading task at hand. The structure of textual links is graphically represented as follows:

![Diagram of textual links](image)

The navigational commands like **Quit**, which allows readers to quit the program at any time, and **Prev Page**, which allows learners to go back to the previous pages of the text at any time, are designed to give learners more control of their reading and learning process. The layout of the screen is consistent throughout the whole reading text. Based on the consideration that our users may not know anything about HyperCard, we have decided to label the commands in words such as **Next Page** or **Prev Page** rather than in icons of left or right arrow. Our goal is to build an easy-to-use program that does not require much time to learn and to make the self-directed learning a manageable and rewarding rather than a disorienting and frustrating experience.

**Conclusion**

The development of Yu-gong is in essence a search for effective ways to free instruction from the linear, static and silent constraints of book technology and to utilize computer technology in support of Chinese teaching and learning. Attempting to explore the
possibilities of designing tomorrow’s foreign language textbook, Yu-gong implements a
new information model, hypermedia, which allows foreign language educators to
integrate text, sound, graphics and animation with instantaneous cross referencing into
a dynamic document for active learning. Although technologies like computers may
never be able to substitute for the direct teacher-student interaction, the integration of
Yu-gong or related technologies into a language classroom will challenge educators to
re-examine ways foreign languages are learned and to develop more effective teaching
methods.

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