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The Ohio State University  PH.D.  1986

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AN EXPLORATION OF THE DEVELOPMENT OF
EARLY LITERACY IN
CHINESE-SPEAKING CHILDREN

DISSERTATION

Presented in Partial Fullfillment of the Requirements for
the Degree Doctor of Philosophy in the Graduate
School of The Ohio State University

By

Marilyn Mei-Ying Chi, B.A., M.A.

***»««

The Ohio State University
1986

Reading Committee:
Dr. Johanna S. DeStefano
Dr. Jerome B. Zutell
Dr. Timothy Light
Dr. C. Ray Williams

Approved by:

Johanna S. DeStefano
Advisor
College of Education
Educational Theory and Practice
To My Husband and Children
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completed partially with Hsin-I Foundation and Pacific Cultural Foundation subsidies.
VITA

July 10, 1949
Born - Taiwan, Republic of China

1971
B.A., National Chengchi University, Republic of China

1974
M.A., The Ohio State University, Columbus, Ohio

1975 - 1979
Lecturer, Assistant Professor, Junior College of China Municipality, Republic of China

1979 - 1982
Associate Professor of Child Development, The Chinese Culture University, Republic of China

1982 - 1986
Graduate Teaching Associate, The Ohio State University, Columbus, Ohio

FIELDS OF STUDY

Language Arts and Reading
Dr. Johanna S. DeStefano
Dr. Martha L. King
Dr. Jerome B. Zutell
Dr. Victor Rentel

Early Childhood Education
Dr. C. Ray Williams
Dr. Marlin Linguist
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CHAPTER ONE
INTRODUCTION

Statement of the Problem

Children are active constructors; they discover, hypothesize, test, approximate, invent and correct their utterances and intentions on the basis of their interactions with the environment (Applebee, 1978; Berko, 1958, 1969; Brown, Cazden, and Bellugi, 1969; Chomsky, 1970, 1971, 1972, 1975, 1979; Clark, 1976; Clay, 1975; Donaldson, 1978; Durkin, 1966; Ferreiro, 1978, 1981; Goodman and Burke, 1972; Halliday, 1975; Harste, Burke, and Woodward, 1981, 1983; Henderson and Beers, 1980; King and Rentel, 1979; McNeill, 1966; Read, 1971, 1975; Vygotsky, 1962, 1978). They implicitly construct identifiable abstract rules and strategies toward an acquisition of knowledge and skills, including reading and writing, before formal schooling. While this innate-constructivist paradigm of language learning has been generally applied to language and literacy learning of those languages with alphabetic writing systems, e.g., English and Spanish, comparatively very little is known about how different writing systems, particularly logographic systems like Chinese, affect the learning process.

It was generally thought that because of the different characteristics of Chinese and English in spoken and written language
(phonology, morphology, orthography, syntax, and semantics), the learning strategies of beginning learners may be different. Beginning-readers in different writing systems may face different learning tasks when they learn how to decipher and to write printed symbols constructed on different principles (Hung and Tzeng, 1981; Tzeng and Hung, 1980). Thus, the match between the task demands imposed by various writing systems and the developing cognitive structure of the beginning learners may be one of the essential factors affecting learning early reading and writing (Clay, 1972; Downing and Leong, 1982; Gibson and Levin, 1975; Zutell, 1978).

Up to now, there has not been any research based on the innate-constructivist paradigm looking at how Chinese-speaking children learn linguistic tasks in the process of early literacy, on what linguistic features in the Chinese logographic system serve as the cues for the Chinese beginning learners, or on what systematic constructive patterns in early literacy learning are different in Chinese, if they are, from those used in learning English. Thus, the use of Chinese should provide excellent opportunities for the investigator in this study to examine how children of different languages and cultures adjust themselves to meet various task demands imposed by different orthographies (Hung and Tzeng, 1981; Tzeng and Wang, 1983) when learning to read and write.

**Purpose of the Study**

This study proposes to investigate the early literacy learning processes of Chinese-speaking children in terms of the patterns and
strategies used in early writing and reading, including their use of Chinese orthographic cues. The research seeks to gain insight into the nature and characteristics of this early written language development by examining the cueing systems of Chinese orthography from three aspects: (1) the available orthographic cue systems inherent in Chinese writing system, (2) the erroneous patterns—termed miscue patterns (Goodman, 1965, 1969), to avoid negative connotations—in early writing/spelling and reading, and (3) the strategies utilized in graphic-sound-meaning association.

It is anticipated that this research will yield insight into the early literacy learning process of young Chinese-speaking children and also into determining whether or not there may be universal aspects of that learning process. Ultimately, then, this study can possibly contribute to the examination of the hypotheses about universals of linguistic, cognitive, and meaning potential (Chomsky, 1957; Halliday, 1973, 1975; Slobin, 1973) across various writing systems and cultures. Also, the identification of learning strategies utilized by the Chinese-speaking children can assist in furthering our understanding of written language growth and development in contexts across languages and orthographies.

**Research Questions**

Integrating research and theory from interdisciplinary fields—language learning, linguistics, psycholinguistics and child development—to build a solid conceptual basis for the study yielded a wide array of developmental and learning dimensions to be examined.
Moreover, the researcher's native language, Chinese, as well as her years of experience in teaching and studying in early childhood education, have provided insights into the issues needing to be investigated. All these issues are formulated in three questions which guided the research to investigate the orthographic cueing systems used by Chinese-speaking children. They are:

a. What available orthographic cue systems inherent in the Chinese writing system are utilized by Chinese-speaking children in word recognition? What developmental differences, if any, exist?

b. What miscue patterns are made by Chinese-speaking children in early writing/spelling and reading? What developmental differences, if any, exist?

c. What strategies are used by Chinese-speaking children in early writing/spelling and reading? What developmental differences, if any, exist?

Procedures of the Study

The purpose of this study is to investigate and describe the early literacy learning process of Chinese-speaking children in terms of the patterns, strategies, and characteristics of the evolution of early writing and reading, including the use of Chinese orthographic cues.

To study language, the first essential is to select the linguistic, cultural and situational setting. The approach chosen was a cross-sectional observational study of 19 three-, four-, five-, and six-year-old Chinese-speaking children in Taipei, Taiwan, the Republic of China, where Mandarin Chinese is the national language. These
children reside in the same suburban county of Taipei but differ in
subculture, particularly in parental educational level and
socioeconomic status. The sample was stratified by sex, age and
socioeconomic class, with two boys and two girls in each age level of
three and four, two boys and four girls at age five, and three boys
and two girls at age six (see Table 1).

They were videotaped over a four-day period, performing a series
of simple tasks in a natural setting. The tasks were:

1. writing their names and anything else they wished to write;
2. dictated writing of isolated words;
3. reading isolated words;
4. reading a story book.

Possible lexical cues and patterns inherent in Chinese
orthography were initially determined by the researcher through an
analysis of the internal constructive principles of Chinese
orthography. This analysis served as the fundamental resource for
analyzing the language data. This analysis is fully presented in
Chapter Three. The cues identified are the strokes of character, the
components of character, and the spatial figure of character.

The 19 subjects' language protocols were transcribed after each
observation and used with written protocols to develop the taxonomy
for the miscue patterns in early writing/spelling and reading in
Chinese, for the strategies of associating sound, script and meaning
in Chinese, and for determining the cue systems used in early literacy
access. Furthermore, the miscue analysis for reading (Goodman and
Burke, 1972) was adapted to analyze the children’s oral reading.

The study approach was fundamentally exploratory in nature, intended to discover and interpret each category and pattern of response as well as to preliminarily determine successive levels of development. The data are organized into analytic categories through a conceptual analysis method which proceeds according to steps detailed by Tesch (1980), as well as by Bogdan and Biklen (1982): (1) establish advanced organizers, that is, sort the protocols into certain themes which are ordered according to internal logic or frequency, to derive principles; (2) organize data under principles; (3) search for themes within each organizer; and (4) develop categories, that is, compare the themes with each other and group into categories/patterns according to their meaning. These patterns, categories, and themes provide the conceptual framework according to which the findings of the study are organized, interpreted, and presented. The design of the study is presented in Appendix A.

**Scope and Limitations of the Study**

This study was undertaken as an exploration of the written language development in three-, four-, five-, and six-year-old Chinese-speaking children. Its primary aims were to collect language data in fairly natural settings, to investigate patterns, strategies, and orthographic cueing systems used in the early literacy learning processes of Chinese-speaking young children, and also to determine whether or not there may be universal aspects of that learning. It represents a beginning exploration to find out whether or not the
literacy learning of Chinese-speaking children can be described by the innate-constructivist paradigm.

Because of the time and expense involved in gathering language data, transcribing, and analyzing video-tapes, studies of children's language generally have small populations, as does this study. Due to the nature and design of the study, the data collection period for the language protocol was six weeks in length. However, observation over an extended period of time would provide more information concerning a child's pattern of development. The sample was divided into low and upper-middle socioeconomic groups, but in one location in Taiwan.

Due to funding limitations, the researcher worked as the task administrator, transcription verifier, and analyzer of the video-taped language protocol and written protocol. The videotape operators and the transcriber were trained before data collection. The transcription was utilized as the source of triangulation for internal validity. While providing continuity between the various investigative areas and facilitating maximum understanding of the children's language, these procedures are subject to bias on the part of the researcher.

In addition, there is the problem of linguistic constraints on the linguistic/language resources. Two sets of constraints found by Harste et al. (1981, 1983) are task-interaction effects and pragmatic constraints.

Linguistic resources displayed are dependent upon linguistic constraints present. Alter constraints and you uncover resources. It does not mean that the tasks we personally
developed to study written language growth and development are ideal ones. It simply means that in order to use any task as a vehicle for understanding growth and development one needs to constantly alter and contrast it, in order to expose the constraints it imposes on the language user. The best that any research task can give one is a perspective on the process. That is not say that some perspectives are not more fruitful than others; but rather, it is to say that no single perspective represents truth. This relationship between constraints and resources is an important one. In a very real sense, in order to understand development we must understand the conditions surrounding development. We must know when development is natural as opposed to being an artifact of either our task or our interventions. (Harste, Burke and Woodward, 1981, pp. 86-87)
Introduction

In 1957, the dominant behaviorist explanations of language learning were vigorously challenged by Noam Chomsky, who argued that language learning is a dynamic, creative process. Chomsky portrayed human beings as having a special language competence (Language Acquisition Device-LAD) that enables them to learn an abstract set of rules that underly language structure and to generate an infinite number of sentences. His theory highlighted linguistic form—the phonology, morphology and syntax of the system—and yet emphasized the creative aspects of language production. Studies that emanated from this work documented the way in which children learn the system of formal structures by abstracting rules from the language they hear and applying these rules in their own verbal constructions (Berko, 1958, 1969; Brown, Cazden, and Bellugi, 1969; McNeill, 1966). They showed that children go about learning their native language in a highly systematic way and persist in applying their personal rule system despite repeated exposure to the conventional adult forms. Their learning is more than imitation or a partial rendering of adult speech. Rather, they appear to learn elements of language in ways strikingly similar across children, yet these ways are at times, quite
different from adult usage.

In learning particular features—noun and verb endings for example—children tend to follow a procedure in which they first use the adult forms, i.e., they say *feet, went, or ate*. But they then go through a stage in which they overgeneralize the rules that govern noun and verb inflections and produce such forms as *foots, goed, or eated*. This process of overgeneralizing the rules of the language system to items where they do not apply operates across many aspects of oral language and shows up in their written language as well.

Studies in spelling and word knowledge (C. Chomsky, 1970; Henderson and Beers, 1980; Read, 1971, 1975) indicate that children invent unique spellings based on identifiable abstract principles which are logical and reflect an underlying morphophonological competence. In the development of early writing (Clay, 1975; Ferreiro, 1978, 1981; Harste, Burke, and Woodward, 1982) children also utilize a set of identifiable principles and hypotheses in creating written messages within social contexts. Without formal teaching, young children develop identifiable expectations for print to be meaningful within the linguistic situation and cultural context in which they live.

Moreover, studies of preschoolers' reading performance are filled with the testimony of both parents and children that children are self-taught (Clark, 1976; Durkin, 1966). When reading they seek meaning from the context; they interact with the author's words; that is, they negotiate meanings embedded in the language. Children reveal
this process in the kinds of errors or miscues they make when reading aloud. These miscues give some indication of how they are reading, that is predicting meanings, sentence structures and pronunciations of words (Clay, 1969; K. Goodman, 1965, 1969; Y. Goodman and Burke, 1972).

The studies of early literacy learning of alphabetic writing systems provide strong evidence that children are innately active constructors. They initiate the learning processes. They discover, hypothesize, test, approximate, invent and correct their utterances and intentions on the basis of their interactions with more knowledgeable and skilled partners (Brunner, 1975; Vygotsky, 1978). Much of this early learning is tacit. Children implicitly know language constructions and rules of grammar that they are unable to say or make explicit consciously (Chomsky, 1957; Polanyi, 1966). They implicitly construct identifiable abstract rules and strategies toward an acquisition of knowledge and skills, including reading and writing, much of it before formal schooling.

This study, within the innate-constructivist paradigm, sought to probe into how Chinese-speaking children learn the linguistic tasks in the process of early literacy, what linguistic features in the Chinese logographic system serve as the cues for the beginning learners, and what systematic constructive patterns in early literacy learning are different in Chinese, if they are, from those used in learning English. The study was based on and can be interpreted in the light of theoretical constructs and research evidence relevant to:

(a). lexical representation of English orthography;
studies of early writing in an alphabetic writing system;
(1) scribbling and spontaneous writing,
(2) differentiation of writing from drawing,
(3) the principles of invented print in English,
(4) development of sound-letter relations,
(c) studies of learning characters by Chinese children;
(d) studies of early reading in an alphabetic writing system;
(1) the reading miscue,
(2) children's reading errors or miscues.

**Lexical Representation of English Orthography**

The printed form of the text is called the orthography or the writing system of a language. There are three main types of systems for coding spoken language into writing: (1) logographic writing—written symbols representing linguistic units of morphemes—meaning; (2) syllabic writing—symbols representing the syllable units of speech sound; and (3) alphabetic writing—symbols representing the phoneme units of speech sound. One of the universal tasks for the early learners in all languages is to learn how the orthography represents the spoken language.

**Phoneme-Grapheme Patterns**

English can be analyzed into syllables or morphemes, but these are not the main units represented by the graphemes of the orthography. This unit is the phoneme. However, most English words are lacking in perfectly regular grapheme-phoneme correspondence. Berdiansky, Cronnell and Koehler (1969) analyzed the 6,092 one- and
two-syllable words among 9,000 different words in the comprehension vocabularies of six- to nine-year-old children to establish a set of grapheme-phoneme correspondences. It was shown that vowel grapheme units are associated with the six primary single-letter vowels, a,e,i,o,u,y. Their study found a total of 79 different ways in which single vowel graphemes are associated with pronunciation.

Hanna, Hodges, and Hanna (1971) analyzed by computer 17,000 words representing a core vocabulary for educated people. Three major factors were looked at: (1) the incidence of phonemes which are symbolized by the same grapheme regardless of the position of the phoneme in a word; (2) how the position of a phoneme in a word or syllable affects its spelling; and (3) stress. It was found that the greatest majority of consonants had single spellings which were used 80 percent or more of the time (p. 81). Position in a syllable and stress may have an influence on spelling certain phonemes, while others tend to be spelled more invariantly in spite of stress and position. For instance, /f/ usually spelled with a f at the beginning of a syllabic word as in fat or afar. It may be spelled ph as the second element in a consonant cluster, sphere, and ff when it is in final position as in stuff. The schwa phoneme /ə/ is a major example of stress as a factor in phoneme-grapheme irregular correspondence. For instance, /ə/ is the second vowel in democratic but not in democracy where the stress pattern is different. Furthermore, they programmed a computer with the phoneme-grapheme correspondence "rules" they had found for the 17,000 words and had it spell the words
according to that system of rules. It was found that 49.8 percent of the 17,000 words were spelled correctly. Further, many of the misspellings produced by the computer programmed only with phonological rules were of the same sort as those made by beginning spellers.

From these studies we can see that the phoneme-grapheme correspondence in English is complicated but has a relatively high degree of regularity. It is obvious that the most that can be expected from the knowledge of phonological rules is that they may provide a clue to the sound of a configuration. Phonemes can provide only approximations.

**Lexical Spelling Patterns**

Words pattern in different ways on different levels. One is the phoneme-grapheme correspondence level with a relatively "surface" look at sound-symbol correspondence discussed previously. There is another level—called the lexical spelling level (Chomsky and Halle, 1968)—with emphasis on morphology rather than on phonology. It underlies the phonological realization of words and represents the abstract forms to which phonological rules are applied to arrive at a pronunciation.

In their work, *The Sound Pattern of English* (1968), Chomsky and Halle address the notion of English orthography as a phonologically deep writing system which is related to lexical representation rather than phonological representation. C. Chomsky (1970, p. 298) diagrams:
phonological rules
LETTERS = Segments in <----------------------> PRONUNCIATION
lexical spellings

In other words, the conventional English orthography corresponds more closely to an underlying abstract level of representation within the sound system of the language than it does to the surface phonological and phonetic form that the words assume in the spoken language. Further, C. Chomsky (1970, p. 294) adds that on the lexical and orthographic levels, words that are the same look the same. In phonemic transcription they look different. For instance:

<table>
<thead>
<tr>
<th>Word</th>
<th>Pronunciation</th>
</tr>
</thead>
<tbody>
<tr>
<td>courage</td>
<td>/kɔˈreɪdʒ/</td>
</tr>
<tr>
<td>courageous</td>
<td>/kɔrɪˈdʒəs/</td>
</tr>
<tr>
<td>telegraph</td>
<td>/ˈteɪləɡrɑːf/</td>
</tr>
<tr>
<td>telegraphic</td>
<td>/ˈteləɡrəˈfɪk/</td>
</tr>
<tr>
<td>telegraphy</td>
<td>/ˈteləˌɡræfi/</td>
</tr>
</tbody>
</table>

The English spelling system leads the fluent reader fairly directly to the meaning-bearing items that he needs to identify. He strips away superficial and irrelevant phonological detail. In speech, on the other hand, one operates tacitly on both the abstract and the phonetic levels, with the phonological rules mediating between the two. The phonological rules, e.g., vowel and consonant alternations, stress placement and vowel reduction, etc., have been internalized by the native speakers.

Chomsky and Halle (1968) suggest that this abstract level—lexical representation—which has a semantic function, is highly resistant to historical change and remains the same over long periods of time. For this reason a stable orthography remains effective over time in spite of changes in the way a language is
pronounced. This would explain the use of conventional English orthography in both British and American English.

From this perspective of phonological deep-surface transformation, Venezky (1970) argues that the units of language coded by writing symbols are "morphophonemic," from which the actual phonemes are derived. His studies illustrate that when viewed from the direct spelling-to-sound standpoint, the patterns for these units reveal no regularity; but, when the morphemic structure and consonant environments of the words in which these units appear are analyzed, a single major pattern emerges from which regular subpatterns can be derived. Although exceptions still remain, there are systematic regularities and internalized patterns in English orthography based on the graphemic, morphemic and/or phonemic features of the words or sentences in which they occur.

Read's work on invented spelling (1970, 1971, 1975) illustrates that young children tacitly recognize certain phonetic contrasts and similarities in that they represent these in their original, unique but systematic spellings. What the children do not know is the set of lexical representations (deep structure) and the system of phonological rules (transformational rules) that account for much of standard spelling; what they do know is a system of phonetic relationships (surface structure) that they have not been taught by their parents and teachers (Chomsky, 1970). Young children choose the phonetic properties such as nasality, syllabicity, backness, height, and affrication which are sources for some of the basic rules of
English phonology.

In deciding which letters to choose, the young inventors pay attention not just to phonemes or acoustic segments but also to articulatory features. That is, they tacitly monitor what their mouths are doing during word and letter name pronunciations, and they abstract from these dimensions in choosing their letters. Children pair spellings with segments abstractly categorized in terms of a hierarchy of articulatory features.

Read's work reveals that preschool children tacitly categorize the phonology of English. Children's phonology is highly abstract, and it differs in specific ways from that of adult speakers of English, including, of course, the child's parents and teachers. The reason for this early constructive process is that in English the orthography bears an indirect rather than a direct relation to pronunciation. The ability of the child to interpret the orthography directly at the lexical level should increase naturally as his phonological competence (Chomsky, 1970) increases, and as he becomes more familiar with the relations expressed by the spelling of words.

In the following, studies of constructive errors and erroneous patterns made by English-speaking children in early writing, spelling and oral reading will be reviewed in order to gain insight into what are the orthographic and graphic features, as well as the cueing systems in written language young children attend to and what this might mean for Chinese-speaking children informally learning written Chinese.
Studies of Early Writing in An Alphabetic Writing System

Learning to write is initiated tacitly, as is oral language learning (Cazden, 1969). If a child is given an appropriate tool and a surface for marking, graphic production may begin spontaneously (Gibson and Yonas, 1968; Hildreth, 1936; Legrun, 1932).

Young children organize print in their environment and learn generalized communication strategies in writing forms. Their written communication strategies reflect a movement from global to more differentiated concepts of print; concern for letters or words as units grow out of attempts to communicate complete messages. This phenomenon makes a linear description of development impossible, since children may utilize a sentence or message format while exhibiting little control of letters and words. With this perspective, the following stages set forth by Clay (1975) and Deford (1980, p. 162) function as a framework in this study for understanding children's development of writing in an alphabetic system:

1. Scribbling
2. Differentiation between drawing and writing
3. Concepts of linearity, uniformity, inner complexity, symmetry, placement, left-to-right motion, and top to bottom directionality
4. Development of letters and letter-like shapes
5. Combination of letters, possibly with spaces, indicating understanding of units (letters, words, sentences), but may not show letter-sound correspondence
6. Writing known isolated words—developing sound-letter correspondence
7. Writing simple sentences with use of invented spellings
8. Combining two or more sentences to express complete thoughts
9. Control of punctuation—periods, capitalization, use of upper and lower case letters
10. Form of discourse—stories, information material, letters, etc.

While the above stages are not sequential, there is a suggestion of growing sophistication as more of the child's strategies and concepts become refined, reflecting conventions of written language.

Scribbling and Spontaneous Writing

In Cattell's scale of infant intelligence (1960), the normal age for a child to scribble spontaneously when given pencil and paper is 18 months. Given a demonstration, he will produce scribbles even earlier. The child is interested in looking at the traces he is making and will cease at once if he cannot see his production. Gibson and Yonas (1968) studied scribblings of 14 children, ranging in age from 15 to 38 months (mean age 28 months) in free play setting at their homes. It was found that the act of trace making—termed "fundamental graphic act" by the researchers—helps the child distinguish the variables of graphic information—straightness, curvature, continuity, closedness, intersection, and so on—variables that he must be able to distinguish and use as a feature set when he learns to read. Scribbling seems to be its own delight. It furnishes an unparalleled opportunity for learning the relations between the
finger movements that guide the tool and the resulting visual feedback.

Hildreth (1936) and Legrun (1932) studied children's early productions of "writing" and classified them into stages or levels. Legrun's observations (1932) resulted in five stages:

Stage 1. Unorganized scribbles
Stage 2. Zig-zag lines without much variation in form.
Stage 3. Better-articulated forms showing some variation of structure but not broken up into parts
Stage 4. Increased differentiation of forms with linear arrangement of elements divided up to look like words.
Stage 5. Further differentiation with occasional interpositions of true letters and figures.

Hildreth (1936) observed the writing behavior of children between three and six at a private school in Manhattan. The children were given materials and asked to write their names or any letters or numbers they could make. She set a zero level, a scribble, below three years.

Level 1. Something beyond aimless scribbling with considerable tendency toward the horizontal and some systematic 'up and down' scratching
Level 2. A more regular form of level 1 with consistent linearity.
Level 3. A greater variety of features used contrastively. A contrast between straight lines and curves, opposite diagonals, and intersection was used.
Level 4. Had well-marked units and real or approximation to real letters.

These children were all classified as prereaders. Their parents had not encouraged the children to write, leading Hildreth to conclude that writing improves from ages three to six without any direct instruction.

Similar findings about the way kindergarten children taught themselves to write letters and words in their first year in school were reported by Wheeler (1971). Children were given no formal instruction in reading, letter names, or letter-sound correspondences; but they were given examples of writing, word cards, and the alphabet along with notebooks, and told to do their writing in these books. Wheeler's results indicated the following progression: designs, pictures, letters, words in isolation, word phrases, words in sentences and finally, symbols. She concluded that children improved over the year apparently by spontaneous self-correction and self-motivation.

In summarizing these results, it was found that as early as age three, many children are producing forms that contain features that are characteristic of writing and not of pictures—linearity and horizontal orientation. Many at this age also produce variation of height.

**Differentiation of Writing from Pictures/Drawing**

Both pictorial representations and writing develop from the 'fundamental graphic act', taking diverse courses. How early does a
child perceive the difference between a pictorial representation and a nonpictorial graph? How early does he perceive writing as writing? Lavine (1972) investigated this question with children in Mexico between the ages of 3 and 6.5 years who had not yet been taught to read. Her essential method was to show a number of graphic displays to children, to see whether they could classify the displays as pictures or writing. Then, she asked them more precise information in order to determine their ability to distinguish both.

The variables chosen by Lavine for investigation were iconicity (pictorial representativeness), multiplicity of units, linearity, variety of units, and graphic characteristics of individual writing systems, such as the Roman alphabet, cursive writing, Hebrew writing, and Chinese characters. These variables were contrasted in separate displays and also combined in various ways, such as a presentation of a linear, multiple-unit, iconic display.

It was found that even three-year-olds distinguish between graphic displays depicting objects and those containing letters (single letters or a word), whether or not they are able to name the letter or read the word. The set of internal contrastive features used for writing and some of the global characteristics, like variety of elements and multiple units, are the component features that differentiate writing and pictures/drawing. Particularly, it needs to be pointed out from the findings of this study that even three-year-old children in Spanish alphabetic writing system still recognized Chinese logography as writing and not pictures/drawing.
These tests were given to two groups of children in Yucatan, Mexico— one in a city in a fair stage of technological advancement (Merida), and one in a remote rural village where reading matter and print were rare. The children growing up in the culture that provided a very limited exposure to print were by no means as knowledgeable about writing as the Yucatan group. Therefore, cultural setting was at least as significant a variable as age. It is interesting that children from different literate environments all distinguished pictures from writing at three years.

The Principles of Invented Print in English

Clay (1975) suggests that children's writing should be viewed as a developmental language system, and that children's writing "errors" are actually signs of progress reflecting the use of rules or ambitious attempts to communicate meanings. Clay provides thirteen principles of early writing to guide the observation and study of children's writing samples.

1. **The Sign Concept** This is an early and easy concept. A sign carries a message.

2. **The Message Concept** Children realize that the messages that they speak can be written down.

3. **The Copying Principle** Some letters, words and word groups must be imitated or copied in a slow and laborious way to establish the first units of printing behavior.

4. **The Flexibility Principle** Children create a variety of new symbols by repositioning or decorating the standard forms.
5. The Inventory Principle  Children spontaneously make lists of what they know. They arrange or consciously order their learning.

6. The Recurring Principle  Children have the tendency to repeat an action.

7. The Directional Principle  For correct directional behavior a top-left starting position is mandatory, movement must proceed from left to right; and a return sweep is taken back to a left hand position under the starting point, to establish the top to bottom progression. This pattern of movements must be carried out in a particular sequence. The directional learning to be mastered by the new entrant can be described as a four step schema made up of the following stages:
   a. start top left
   b. move left to right across the word or line
   c. return down left
   d. locate next starting point

8. The Generating Principle  Children know some elements and rules for combining or arranging these elements.

9. Reversing the Directional Pattern  Mirror writing at this stage is a lapse in the sense of body in space as it relates to the page of a book rather than a lapse in visual perception.

10. The Contrastive Principle  Writing contrasts in visual form,
letters, meaning, and sounds.

11. The Space Concept A space must be used to signal the end of one word and the beginning of another.

12. Page and Book Arrangement Children may know the directional principles and operate within them, but they encounter new difficulties when they run out of page and cannot fit their word or sentence on the line or on a page.

13. The Abbreviation Principle This refers to the deliberate attempt to use one symbol, implying a full word, which children could fill out or get help in filling out if they were asked to.

What is significant in this study is that Clay considers the totality of children's writing and shows children from the very beginning intending to represent meaning in their productions.

An English word is written linearly by letters, while a Chinese character is written globally in a square frame by strokes. English printing goes in rows from left to right, while Chinese printing goes in columns from right to left. English and Chinese are different in script and orthography. However, the thirteen principles of children's invented print in English set forth by Clay (1975), could provide a grounding framework in this study for examining Chinese children's invented print.

Development of Invented Spelling/Sound-letter Relations

In alphabetic systems, the development of children's speech-script matching goes through a consistently generative process from scribbling (Lavine, 1972), to syllabic hypothesis (Ferreiro,
1982), and then to alphabetic hypothesis (Read, 1971, 1975). The developmental procedure is elaborated as follows:

A. Children scribble at a very early age. Thereafter, their aimless markings evolve into precise drawings. Dealing with the differentiation of drawing and writing, it was found that (Lavine, 1972; Ferreiro, 1982) even three-year-olds distinguish between graphic displays depicting objects and those containing letters, whether or not they were able to name the letter or read the word. Children who write with unconventional signs organize the elements of their production in a linear order, which is very different from the order of the elements composing a drawing. They develop the concept of sign and print (Clay, 1975).

B. Moving to the next stage, children use a single symbolized convention and/or letter-like graphic to represent one sound (acoustic) segment which naturally is a syllabic segment in speech perception, and also to represent each image of an object. In this stage, they acquire the concept of symbol, and construct the syllabic hypothesis for speech-script matching.

C. At this stage, the young children recognize and represent words in terms of their initial sounds only, e.g., F for Friday (Paul, 1976). At this point, they are in the transition from syllabic hypothesis to alphabetic hypothesis. They use the letter of the first phoneme of the acoustic word segment to represent the speech. In the syllabic hypothesis, it is believed that every written symbol denotes a syllable in the spoken language. As we can see from cuneiform
syllabaries, west Semitic syllabaries, Aegean syllabaries, and Japanese syllabaries, the design feature is a close symbol-sound relation.

D. Children **construct the alphabetic hypothesis and test it**. They become aware of letters in a word unit. They know that they need several letters, without knowing how many, and without knowing the reason that may determine the range of variability in the unit. The understanding of the requirement of various graphemes for the writing of a single word is exhibited.

The **letter-name strategy** emerges (Beers and Henderson, 1977; Chomsky, 1970; Paul, 1976; Read, 1970, 1971, 1975). As the name implies, children spell by the **phonemic feature** that is emphasized in each letter as it is named in the alphabet of their language. In this stage they pay attention not just to phonemes or acoustic segments but also to articulatory features. They monitor what their mouths are doing during word and letter name pronunciations, and they abstract from these dimensions in choosing their letters. But, they still become confused in comparing and alternating the letter-name and word-sound pronunciation, such as U for YOU, R for ARE. Chomsky (1971) cited the following inventions as typical—GRL for GIRL, MN for MAN, U for YOU, R for ARE, YL for WHILE, DCTR for DOCTOR, and CHRAN for TRAIN.

In the letter-name stage, children have a clear concept about the alphabetic hypothesis which means they set the hypothesis of letter-sound correspondence and test it. For example, children
commonly spell track and chicken very similarly as HCRAK and HCICN, because they detect affrication at the beginning of both words and they select the letter H because the latter part of the name of this letter (ai) has this same sound. At this point, they are not familiar with the regularity and irregularity of English orthography, they overgeneralize their own rules depending upon their alphabetic hypothesis of selecting certain phonetic rather than phonemic characteristics.

E. The next is labeled vowel transition (Henderson, 1980). Children show some degrees of awareness of lax vowels and the *silent-letter* marker such as LEF for LEAF, LIF for LIFE. In this stage, they set the rule of the spelling-sound correspondence in consonants, primary vowels, secondary vowels and consonant clusters (grapheme units), and test these rules. Children at this stage are getting more familiar with the regularity and irregularity of the English sound-grapheme structure.

F. Children move to the morpheme stage. In English spelling, changes in tense, number, and part of speech are often indicated by word ending (-ed, for past tense; -s or -es for plural). These meaning-bearing elements are typically spelled the same even when they are pronounced differently because of different phonological environments. For example, contrast the different pronunciations of -ed marking past tense in kissed, /kɪst/ vs. planned, /plænd/ vs. lifted, /lɪft/ (Beers and Henderson, 1977; Venezky, 1970). At this point, children are either unconsciously or consciously aware of the
characteristics of the alphabetic system (in English at least) as a morphophonemic representation reflecting the phonemic nature of its spoken sounds and the inflectional character of its lexicon and syntax.

In this research, there is ample evidence that children in several areas of language learning first develop their own system and structures and later take on the conventional system. Studies in spelling and word knowledge reveal that children, before they learn standard spellings, invent ways of representing sounds in words that are not adult-like, but are logical and predictable before they learn the standard spellings. Clay (1975) and Ferreiro (1980) found that children use similarly unique concepts or principles to guide their early attempts in writing. Moreover, Ferreiro's research (1980) with preschool children from Mexico suggested that the findings of Clay, Read, and Lavine about the development of written language not only apply to preschool children of highly literate parents, but also to preschool children whose parents are illiterate. These studies tend to illustrate the universals of development in differing contexts.

Studies of Learning Characters by Chinese-speaking Children

Van Zian (1962) studied first graders learning characters in a Shanghai primary school. Character learning took place in three stages. In the first stage, the children related previously learned sound/meaning associations with only the global shape of written characters. In the second stage, they associated sound/meaning with parts of characters and often wrongly substituted parts from similarly
shaped characters. In the third and final stage, they were able to make the correct associations between sound/meaning and the correct strokes of characters. Character learning throughout the three stages was dominated by the visual aspects of the characters.

Ai (1950) reported that the use of the six constructive principles—six graphs—facilitated children's learning of characters: the same children scored three times higher when the six principles were explained than when they were ignored. This was so whether the children were tested immediately or three months after learning.

In another study, Tzeng and Hung (1980) asked Chinese readers to read a section of prose containing about 1,500 characters and to circle concurrently all characters containing certain graphemic components such as 胎, tāi, 'an embryo', or 快, jī, 'pleasant.' These two graphemic components as phonetic parts sometimes indicate pronunciation and sometimes do not. For example, the sound of tāi, 'an embryo' corresponds with the sound of 台, tāi, 'a raised platform' whereas that of 快, jī, 'pleasant' does not. It was found that the subjects detected more characters in which the designated graphemic component carried a phonetic clue.

Unfortunately, very little research is available on early writing/spelling and reading by Chinese-speaking children.

Studies of Early Reading in an Alphabetic Writing System

Reading and writing are complementary. Clay (1972, p. 61) stated, "By these two processes the child comes to understand the hierarchical nature of letters, words, and utterances." Writing often
provides the opportunity to pay attention to such detail, and to letter order, sound-symbol correspondence, clustering of vowels (ee, oo, ou) and consonants (sh and ch). The research of Read (1971) and C. Chomsky (1971) gives us insight into the way children begin to build their written orthographic systems through their invented spelling before schooling. On the other hand, studies of early reading (Bissex, 1980; Clark, 1976; Clay, 1972; Durkin, 1966; Harste, Burke, and Woodward, 1981) provide evidence that some children do learn to read before school without direct teaching from parents.

Reading is a complex set of cognitive activities by which the reader attempts to reconstruct the message of the author transmitted through print. Clay (1972) defined reading as: within the directional constraints of the printer's code, language and visual perception responses are purposefully directed in some integrated way to the problem of extracting meaning from cues in a text, in sequence, to yield a meaningful communication, conveying the author's specific message (p. 6). In the reading process, the reader brings the sum total of past experiences, including knowledge of language, to the task, using his information to efficiently sample the text, testing and confirming or rejecting internally generated predictions about the intended meaning. In order to efficiently sample the text, the reader looks for and utilizes visual or graphic information as well as nonvisual information—cueing systems inherent in oral and written language, i.e., semantic, syntactic, and orthographic—to sample the text.
In the constructive process, systematic errors are seen as natural and expected. In the Piagetian perspective, constructive error constitutes necessary prerequisites for arriving at the correct solution (Ferreiro and Teberosky, 1982; Piaget, 1955). In reading, several investigators (Biemiller, 1970; Clay, 1969; Goodman, 1965, 1967, 1969; Weber, 1970) have demonstrated that such errors—termed miscues, to avoid negative connotations—provide a means of gaining insight into the reader's strategies for dealing with written language. Goodman and Burke (1972) further point out that what is important is not the miscue itself, but the quality of the miscue and how that miscue aids or hinders the reader's efforts to reconstruct the meaning of the text.

The Reading Miscue

K. S. Goodman (1965) defined reading as the reconstruction of meaning derived from the reader's interaction with written language. He used his interpretation of reading to develop a taxonomy of reading which described the reader's miscue patterns (Goodman, 1969). Consequently, Y. Goodman and Burke (1972) developed the Reading Miscue Inventory (RMI) as a simpler version of the taxonomy for assessing miscues. In general, studies based on the Goodman's taxonomy and also the RMI suggest that readers use information from graphophonic, syntactic, and semantic sources. Readers use such information interchangeably in a three-step cycle, involving sampling, predicting, and confirming.
The Reading Miscue Inventory presented a qualitative analysis of oral reading performance with the profile sheet (see Appendix B) which provided no indication of overall oral reading accuracy but with numerous analyses reflecting qualitative aspects of the performance.

In the RMI, the five patterns of miscues, i.e., substitutions, omissions, insertions, reversals, and repetition are marked and rated on general criteria, including graphic and sound similarity, grammatical acceptability, semantic acceptability, meaning change, correction, and meaning loss. Consequently, three reading categories are extracted as sound-graphic relationships, grammatical relationships, and comprehension patterns. Thus, rather than focusing on quantity and an analysis of graphemic and phonemic aspects of oral reading errors, miscue analysis is an attempt to depict which cue systems the reader uses, with the focus on whether "error" will result in a meaning loss to the reader.

**Children's Reading Errors or Miscues**

When young children encounter a book, as Clay (1967, 1972) has pointed out, there are several stages they must go through before lifting a book to read. These involve orientation to the book, print, and a notion about written languages. On this aspect of beginning reading, *Diagnostic Survey and Concepts about Print Test* (Clay, 1972) and two small paperback books, called *Sand* and *Stones* which are designed for the test, have been developed by Clay. The test provides information about young children's knowledge of book, letters, words, sounds, and punctuation.
As children's experience and knowledge about books and reading grows, they begin to perceive how the system works. They draw attention to sound-symbol correspondence and language patterns. Weber (1970a, p. 450) found that even beginning readers expect what they read to conform to the structure of the language they already know, and they actively use this knowledge as they read. The degree to which beginning readers' use of their oral language is reflected in their reading behavior was investigated in studies carried out by Biemiller (1970), Clay (1968, 1969), Goodman (1965, 1967), and Weber (1970a, 1970b).

Biemiller (1970) examined children's miscues in terms of using graphic and contextual information as beginning readers learn to read. A high proportion of syntactic agreement and a three-phase developmental model were found. The first phase was typified by contextually constrained responses, i.e., children's errors "made sense" but were not graphically similar to the text. The second phase was characterized by an error pattern in which more than half of the errors were nonresponses and which showed a decline in contextually constrained errors and greater proportions of errors showing attention to graphemic information. The third phase presented a decrease in nonresponse ratio to less than half and more errors constrained by both contextual and graphemic information. Biemiller found this increase in using graphic information resulted in a major change in reading ability as children extended their range of strategies. He posited that Phase 2 was a transition stage when the children became
aware of correspondences between word sounds and graphic pattern. Biemiller also noted that high-progress readers spent only a short period in the first phase but that the duration of stay at the second phase had little relationship to final attainment.

Clay (1968, 1969) and Weber (1970a, 1970b) both expand on this description by emphasizing the role of sentence structure in shaping errant responses to text. In these studies, beginning readers' errors were shown to be constrained particularly by syntactic elements. In particular, in each of the investigations, errors of both the average and high-progress readers reflected syntactic congruity in at least 70% of the occurrences. When grammaticality was accessed only in relation to the immediately preceding context, the acceptability level rose to 90% or better.

Weber (1970b) also reported an increase in the graphic similarity of errors across time. Clay (1968) noted that beginning letters were apparent as cues in 49% of errors with graphic similarity to the text. Self-correction behavior also changes across time. Clay (1968, 1969) and Weber (1970a, 1970b) both note that average and high-progress readers tended to self-correct only the errors that violated contextual constraints and that were obviously incorrect, given the ending structure. Clay (1969) notes, however, that only about one-third of all errors were corrected by the better readers.

K. S. Goodman (1965) and Allington (1979, 1980) have studied oral reading errors in isolation and in context at the word-identification level. Goodman (1965) demonstrated the noncomparability of oral
reading errors in context and errors in isolated word recognition. Allington (1979, 1980) reported results, which supported Goodman's (1965) finding, in that relatively few words were misidentified in both isolation and context conditions. These results suggest that an analysis of oral reading errors has limited value in identifying which words a reader might misread in other contexts. No evidence from these studies showed that specific errors in either condition will reliably predict specific errors in the other.

The overall findings from the studies of early oral reading provide evidence that reading is not simply a series of letter-to-sound-to-word-to-meaning process. It is a cue-seeking constructive process. In addition, beginning readers have to learn to integrate newly acquired graphic and orthographic information with their already available and growing knowledge about the contextual cueing systems—syntactic and semantic. The success in doing so is reflected in an increasingly higher percentage of miscues that are both contextually and graphically constrained.

In conclusion, a review of the literature in early literacy learning with alphabetic writing systems, e.g., English and Spanish, suggests that children are active constructors. They implicitly construct identifiable abstract rules, patterns, and strategies toward an acquisition of knowledge and skills, including reading and writing, before formal schooling. Unfortunately, very little research is available on early writing learning by Chinese-speaking children (stated previously). In addition, no research was found on early
reading learning by Chinese-speaking children, particularly based on
the innate-constructivist paradigm of language learning. Thus, this
study endeavors to probe into the early literacy learning process of
Chinese-speaking children in terms of the miscue patterns and
strategies of early writing/spelling and reading, including their use
of Chinese orthographic cues. In addition, the intent behind this
study is to explore the extent of possible application of the
innate-constructivist paradigm of language learning to learning the
Chinese logographic writing system. This perspective and concerns
formed the basis for this study.
CHAPTER THREE

THE LEXICAL CUES OF CHINESE ORTHOGRAPHY

The Nature of the Chinese Language

The Chinese language has seven major dialect families (Li, 1973). They are different primarily in pronunciation (including tone) and sometimes in vocabulary, syntax and semantics. Most are mutually unintelligible for speakers who have had no previous speech contact with those dialects. However, there are the common written symbols, called characters, that have made communication possible among speakers of different dialects. In this study, the Mandarin dialect is used as the term for the Chinese language because this dialect has the status of a national language both in China Mainland and Taiwan.

Phonology

The Chinese language fundamentally is tonal and monosyllabic. Practically all morphemes are monosyllabic. A syllable is made of three constituents: the initial, the final and the tone. The initials are consonants (or sometimes there is no initial); the finals are vowels and three consonantal endings, i.e., /n/, /j/, /r/; and there are four tones. All told, there are 22 consonants (initials), 37 finals, 440 syllables and 4 tones (see Appendix C).
Morphology

The Chinese language is known as an isolating, noninflectional, or analytical language, in which each word consists of just one morpheme and cannot be further analyzed into component parts. In other words, it has a general lack of complexity in word formation, i.e., derivation and inflection. In English, for example, the word ‘admire’ has at least eight forms: admire, admires, admired, admiring, admiration, admirable, admirably, admiringly, while Chinese uses the same form for all.

Homophony

The fundamentally monosyllabic, monomorphemic, and isolating characteristics of the Chinese language have produced some remarkable results in homophony. In addition, due to the historical sound-simplification and shift of consonants and vowels (Karlgren, 1923, 1949), many words have thus become homophonous. Though the existence of the various tones reduces considerably the number of exact homophones, it is evident that the existence of tones does not form a perfect remedy. Therefore, the Chinese use two ways to solve the homophonous problem (Karlgren, 1923, 1949). In the oral mode they make elucidative additions to the simple characters/words, in terms of compound words which are polysyllabic and polymorphemic (free morphemes) in general; while, in written mode the script distinguishes to the eye what is homophonous to the ear. The Chinese add a signific (radical) part as a signifier not only to indicate the semantic catalogical meaning, but also to prevent the confusion of homophones
in heterographs. Due to the scope of this study, only the homophones in the written mode are discussed to provide a grounding framework in this study for examining Chinese children’s early reading and writing.

Radical (Signific) Part - The Way to Resolve Homophones in Written Mode. The nature of the Chinese script—a logographic, not a phonemic writing system—brought about a remarkable situation. If the Chinese had possessed an alphabetic script like English, all these homophones would have been quite as indistinguishable in writing as in speech. But the script distinguished to the eye what was homophonous to the ear. Out of the 71 words of i (in the falling tone), each i has its own script/character indicating the meaning of the word without reference to the pronunciation or the subsequent changes in the pronunciation of the word. However, as in speech the 意, i for ‘meaning’ came to be inadequate and was amplified into 意思, i-si, ‘meaning’. Then it became a satisfactory and distinct symbol for ‘meaning’.

As early as 1,766 B.C., the Chinese had created a method of phonetic writing to deal with the unique oral and written modes (Karlgren, 1923, 1949). The literal translation of this method is "symbol-sound". Western scholars translate it as "phonogram" or "compound phonetics", but in order to maintain the nature and the original function of the writing method, this researcher prefers to use the translation "signifier phonogram". The character has to consist of one phonetic part indicating or at least suggesting the pronunciation of the word, and one significant part indicating or at
least suggesting the sense of the word or giving the category to which it belongs.

**Chinese as Logographic Writing**

The Chinese writing system is classified as logography by Gelb (1963); that is, the morpheme-syllable is the unit of speech coded by the Chinese writing system. The unit is called 字, zì in Chinese, 'character' in English. Chinese is almost a perfect example of morphemic writing (Gelb, 1963) in which each 字 represents a morpheme, and since most (99%) morphemes are monosyllabic, each character also corresponds to a syllable. Since in old Chinese a morpheme was usually also a word, Chinese can also be described as a word-sign system of writing (Chao, 1968).

In English script, spaces are placed between words. So "man", "gentleman", "gentlemanly", "ungentlemanly", and "ungentlemanliness" are each written as a single word, even though the last word contains five morphemes, whereas the first contains only one. In Chinese script, on the other hand, the spacing is based on the morpheme. Hence, a compound word which is a polysyllabic-polymorpheme like tricycle has three morphemes in Chinese, 'three-wheel-vehicle', and is therefore written with three characters—三輪車, sān-lún-chē and read as three distinct syllables.

Thus, perceptually, the grapheme-sound mapping for any dialect of Chinese is discrete in a consistent manner, whereas in English script the relation is continuous and at a more abstract level—syllable and phoneme segmentation (A. Liberman et al., 1967, 1972; I. Liberman et
This difference may have strong implications for the beginning learners of these two scripts. For Chinese children, the written array is dissected syllable by syllable and thus has a one-to-one correspondence with the syllabic boundaries of the spoken form.

However, there is an ambiguity in the spatial structure of Chinese writing; no extra space is left between groups of characters constituting one compound word. And since in modern colloquial writing a great number of compound words are used, the lack of space may also have some negative effects for the beginning and the non-native readers because there is no spatial cue to distinguish compound words from single morpheme words.

**Internal Constructive Principles of Chinese Orthography**

**The Strokes of the Character**

In any writing system, a spatial unit is able to be discerned, called "frame", a deliberately neutral term (Wang, 1982, p. 226). A rather superficial difference among scripts is that in some the frames move horizontally in rows, whereas in others they move vertically in columns. Furthermore, the frames within rows may move from left-to-right as in English, from right-to-left as in Hebrew, or even alternate in direction in boustrophedonic fashion as in some ancient Greek inscriptions (Gelb, 1963). Similarly the columns may go from left-to-right and conversely. Chinese printing goes in columns from right-to-left. It has been occasionally written in rows from left-to-right.
In the Chinese language, the script in each square frame is composed from 12 basic strokes. In general, the strokes fall into two broad groups:

Group 1: Simple strokes running in one direction
- 点 (dot)
- 拾 (rising)
- 横 (horizontal stroke)
- 直 (straight stroke)
- 左撇 (pursing in the lower left direction)
- 右捺 (pursing in the lower right direction)

Group 2: Strokes in two directions
- 横钩 (vertical hook)
- 直勾 (horizontal hook)
- 拾勾 (rising hook)
- 龙勾 (dragon hook)
- 弓勾 (bow hook)
- 斜勾 (oblique hook)

The Principles of the Stroke Order. There are four ways to organize the stroke order in the frame of each character. But all of them share a common characteristic, that is, the first stroke always starts from the left top corner of the frame to right or to bottom. The four principles of stroke order are as follows:

1. The writer begins every character from the left to right, usually writing the horizontal stroke first except the cross stroke figure.
   e.g.,
The Number of the Strokes. The number of the script strokes could vary from one to thirty. The results of the studies by Chuang (1938) and Leong (1973) are almost identical with 11.27 as the mean number of strokes used for these characters and 4.45 as the standard deviation. The correspondence is all the more remarkable in view of the time span of some thirty years between the studies and the different approaches. The frequency distribution of the characters by stroke number is shown in Appendix D. The number of strokes is often mentioned as dominating the task of learning the characters. In comparison with English, Woodworth (1938) found that most of the familiar words have as many strokes as English words of 12-20 letters. The stroke does not represent the sound and semantic entities as do
English letters or letter clusters.

The Spatial Figure of the Character

Chinese characters are arranged in a column, every column starting from the top of a page. Columns are arranged from right to left so that a page of a book is turned from left to right (the opposite of the western manner). Recently, under Western influence, horizontal writing has started to appear occasionally. Punctuation marks also have been adopted in many texts.

Each character is written in a square-shaped frame. Based on the internal constructive principles of the character, the frame is constructed by two main types of form—single form and compound form in the perceptual display.

The Single Form

The pictographs and the simple ideographs occupy the full square frame as in 日, "sun"; 水, "water"; and 本, "origin"; etc. The exception is 门, "door" which, although it is a pictograph, is vertically divided perceptually.

The Compound Form

The compound ideograph and signifier-phonograph occupy a part of the square frame of the single form in vertical, horizontal, and enclosure positions.

Vertical Position Calculating from the 9,029 modern Chinese characters, 5,847, or 66.5% of the characters are in vertical positional form. Using the radical part as the variable to calculate the frequency of the radical position, the distribution is as follows:
1. 左 Left - 5,065, or 57% of the total characters
   e.g., 河
2. 右 Right - 768, or 8.5% of the total characters
   e.g., 鄉
3. 左 and Right - 14, or less than 1% of the totals
   e.g., 街

Horizontal Position There are 1,771, or 20% out of the 9,029
characters in horizontal positional form, using conventional usage in
the Chinese dictionary as the data to calculate the frequency of the
radical position. The distribution is as follows:
1. 上 Top - 649, or 7% of the total
   e.g., 安
2. 下 Bottom - 1,049, or 12% of the total
   e.g., 古
3. 上 and Bottom - 73, or less than 1% of the total
   e.g., 裏

Therefore, 86.5% of the 9,029 modern characters have radicals in
either one of the two categories—vertical and horizontal. The
frequency with which the left side of the vertical position functions
as a signifier and the right side for phonetics is 57%.

Enclosure There are 2.5% out of the 9,029 characters using an
insider or/and outsider part as the radical part.
1. Inside
   a. 内 Inside - 14, or less than 1% of the total
      e.g., 回
   b. 内 Inside - 58, or less than 1% of the total
      e.g., 友
   c. 内 Inside - 52, or less than 1% of the total
This spatial figure analysis demonstrates the construction of the visual frame is also based on the internal constructive principles of the script—using East/West (left/right), North/South (top/bottom), and inside/outside to fill the square frame symmetrically.

**The spatial positions/patterns of signifier and phonetic parts**

Signifier-phonography has been the most common constructing method in Chinese orthography. The signifier-phonograph consists of two parts, a signifier and a phonetic, the former determining the meaning and the latter indicating or at least suggesting the pronunciation. The phonetic part of the signifier-phonography originally stood for a word similar in sound to the word/character represented by the character. There are six ways to form the spatial patterns of signifier and phonetic parts. They are:

1. left signifier + right phonetics  e.g., 江, 河.
2. right signifier + left phonetics  e.g., 鴉, 鴕.
3. top signifier + bottom phonetics  e.g., 草, 花.
4. bottom signifier + top phonetics  e.g., 息, 忍.
5. outside signifier + inside phonetics  e.g., 圓, 圓.
6. inside signifier + outside phonetics  e.g., 間, 辯.
From studying the spatial positions of signifier and phonetic parts, one can demonstrate that the semantic and phonological representation of the character is correlated with the spatial figure of the script. Calculating from the 9,029 modern Chinese characters, there are 57% signifiers on the vertical left, 8.5% on right; 7% on top, 12% on bottom; 1.5% inside, and 1% outside. It is obvious that the spatial figure of the signifier and phonetic part in Chinese orthography has high regularity. The regularity of the spatial figure could give the reader common features of reference overtly. In an analysis of Mathews' dictionary, Herdan (1962) found that these 17 signifier groups (8% of 214 signifiers) account for 50.12% of the 8,711 characters. The high regularity of a small number of signifiers relates to morphological and script constraints that are analogous to similar features in English orthography (Leong, 1978).

In addition, the stroke number of all the signifiers is $7 + 2$ or $7 - 2$, just like the magic number proposed by Miller (1956). The intercharacter redundancy and the critical number of the intracharacter could reduce information processing time and increase economy. Learning in this way is perceptual and cognitive learning, not just rote memory. Thus, to say that in learning Chinese characters one has to rely on rote memory to remember 50,000 characters is overstated and incorrect. What the learner has to look for is the more tacit invariant identifiable rules rather than strokes and individual elements.
Moreover, from studying the figures, it was found that the construction of the visual frames is also based on the internal spatial constructive principles of the script—east/west (left/right), north/south (top/bottom), and outside/inside, to fill and balance the square frame symmetrically. The spatial design in Chinese script is quite different from the linear construction in the alphabetic writing systems.

Although the script is written in a square frame which is visually more global than the linear alphabetic writing, in order to write there are principles to encode the vertical, horizontal, curvilinear, and oblique lines as well as dot into the square configuration to compose a character. Each unit of the spatial figure is composed from 12 basic strokes. The spatial position of the stroke is one of the main structural components. The different position makes different words such as 八, 五, 'the fifth of the ten celestial'; 八, 十一, 'the eleventh of the terrestrial branches'; and 八, 守, 'to defend, to guard'. Therefore, the researcher proposes that the awareness of the spatial figure is an essential tacit operator in early reading and writing. And further, Chinese children's concept of symbol and print might be quite different from that of English-speaking children.

In origin and common usage, Chinese text is arranged in a column, every column starting from the top of a page. Columns are arranged from right to left so that a page of a book is turned from left to right (the opposite of the western manner). Thus, the researcher
proposes that the way of handling a book by Chinese-speaking children might be different from that of English-speaking children.

In summary, from analyzing the Chinese orthography, the researcher in this Chapter has extracted out the types of lexical cues of Chinese orthography—the number of the strokes of the character, the spatial position of the strokes, the number of component parts of the character, and the spatial figure of the components of the character. The regularity of the visual features of Chinese orthography might implicitly give readers common reference.
CHAPTER FOUR
PROCEDURES OF THE STUDY

Investigating the early literacy learning of Chinese-speaking children involves recording children's language behavior in natural settings. This chapter describes the procedures of the study, including selection of subjects, tasks used for collecting data, methods of recording/observing, the taxonomies developed for the coding system, and the treatment of the data. The possible lexical cues inherent in Chinese orthography as the fundamental linguistic tasks for analyzing the language data have been presented in Chapter Three.

Population and Setting of the Study

The subjects selected for this study were 19 Chinese children, from ages three to six, living in Mucha County, Taipei, Taiwan, the Republic of China, where Mandarin Chinese is the national language. Description and Selection of the Setting

Mucha, a suburban county of Taipei which is the capital of Taiwan, The Republic of China. Mucha is characterized as an educational-cultural setting in Taiwan's society because of the location of National Chengchi University.

The University Elementary School, designated as an alternative school, is operated by National Chengchi University and is located in
the suburban neighborhood of Mucha county. It provides schooling for 480 children from three years old (pre-kindergarten, kindergarten) to grade six, 90% of whom are the children of the faculty and staff of the National Chengchi University. Grade level labels are used for the first to sixth grade. The family grouping and informal instructional approach are applied in the kindergarten. Also, a wide range of print materials is displayed in reading corners in the kindergarten.

The Men-Dao Public Elementary School, located near the downtown area of Mucha, is operated by the Department of Education of Taipei. It provides schooling for children from grades one to six. Most of the children are from the social welfare recipient families living in the Citizen Apartment Area, set aside for these low income families.

The Mucha Public Preschool, located near the Men-Dao Public Elementary School and designated as an enrichment program, is operated by the Department of Social Affairs of Taipei. It provides schooling for children from age three to five; 95% of the children are from the social welfare recipient families, living in the Citizen Apartment Area, like most of the population of the Men-Dao Public Elementary School.

This particular setting was chosen because these three schools share the same general social-cultural environment and do not give formal instruction in reading and writing. In addition, the researcher, who has lived in Mucha for fifteen years, has an understanding of the social-cultural differences between the two groups described above and had easy access to them.
**Selection of Subjects**

In this study the sample was randomly selected within the stratifications of age, sex, and socioeconomic class. Since the primary aims of the study were to investigate the developmental miscue patterns, orthographic cue systems, and strategies of the early literacy learning process of the Chinese-speaking young children, age was incorporated into the design of the study as a blocking variable. However, the effects of sex and socioeconomic status were not tested in this study due to the scope of this study.

In the sampling plan, four subjects, two males and two females, were randomly drawn from each age level. In each age level, two subjects, one male and one female, were drawn from each of the three schools. In fact, four extra subjects, two five-year-olds and two six-year-olds, were also randomly selected and tested for supplementary information because the data were collected abroad, and it would have been virtually impossible to return later to collect more data if need be. But one of the extra four subjects, age six, was dropped due to illness.

After reviewing the data, it was found that it would be better to use all of the 19 subjects instead of just the 16. The reason was that this investigation is an exploratory study on miscue patterns and orthographic cues in early writing and reading. The larger sample size could help to discern the patterns and cues more clearly (Read, 1975), despite the uneven numbers at each age level.
The distribution of the sampling characteristics is shown on Table 1. Random selection was utilized to select subjects whose birthdays come within a one year range. After selection, permission from parents and schools was obtained to videotape the children in the investigation.

TABLE 1

THE DISTRIBUTION OF THE SAMPLING CHARACTERISTICS

<table>
<thead>
<tr>
<th></th>
<th>3 years old</th>
<th>4 years old</th>
<th>5 years old</th>
<th>6 years old</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>male female</td>
<td>male female</td>
<td>male female</td>
<td>male female</td>
</tr>
<tr>
<td>upper-middle SES</td>
<td>1 1 1 1</td>
<td>1 1 2 1</td>
<td>1 1</td>
<td></td>
</tr>
<tr>
<td>Lower SES</td>
<td>1 1 1 1</td>
<td>1 1 2 2</td>
<td>2 1</td>
<td></td>
</tr>
<tr>
<td>N= 19</td>
<td>2 2 2 2</td>
<td>2 4 3 2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Research Tasks

Task 1: Uninterrupted Writing

The Uninterrupted Writing task involved giving children a blank piece of typing paper and asking them to write their names. Once the children had completed their names, they were asked to write anything else that they could write. At each point that they stopped during this task, the researcher would respond, "write everything you can write." This procedure was continued until the child self-terminated this phase of the task by saying something like, "That's all," or "I
can't write anymore." Then the children were asked to read to the researcher what they wrote. The task was administered individually to each child. All data were collected on videotape. Directions for the observer are presented in Appendix E.

**Task Sequence**

Child is given blank paper and a choice of pencils.

1. Write your name for me.
2. Now write or pretend to write anything else that you can write.
3. Can you write anything else? (repeated until child stops process)
4. Show and read to me what you wrote.

**Materials**

* unlined paper, pencils, crayons (child had a primary and regular pencil available from which to choose)
* audiotape/videotape
* observer/recorder sheet

**Task 2: Dictated Writing of Isolated Words**

In Task 2, children were given a blank piece of typing paper and asked to write the characters/words dictated by the researcher in sentences. The character/word lists were compiled from the high frequency words in the reading materials that were adopted for the young children (Liu, Chuang, and Wang, 1975; Su, 1983). The principle here was a 75% sampling from the story book read by subjects in Task 4 (see below) and 25% sampling from the high frequency words of that restricted corpus that the child had had the opportunity to learn.
Once the child had completed this task, he/she was asked to write his/her name. In the beginning, every subject was encouraged verbally to try his/her best to write or to invent writing. The activity was also recorded on videotape. The list of characters dictated in sentences by the researcher is shown in Appendix E.

**Materials**

* Unlined paper, pencils, crayons
* Characters written in sentences on a piece of paper
* Videotape/audio tapes

**Task 3: Reading Isolated Words**

The task of reading isolated characters/words involved three conditions. In Condition 1, the 15 normal characters were presented; in Condition 2, the same 15 words in pseudo forms were shown; and in condition 3, the same 15 words with parts of them highlighted were used. The characters and the order of the characters were the same as in Task 2.

**Researcher’s Script**

**Condition 1**

In Condition 1, children were shown 15 normal words/characters one by one and asked four questions. The word list is displayed in Appendix E.

1. Here is a list of characters/words that has fifteen words in it. I want you to look through it and then to read or pretend to read to me.

2. Please tell me what this word/character says?

3. Please tell me what this word/character means?
4. Please tell me why you thought this word/character says that? (If they cannot describe the cues which they used, the researcher will go on to ask them which parts they implicitly utilized.)

5. Please tell me anything you know about this word/character.

**Condition 2**

In Condition 2, children were shown pseudo-words, the positions of figures whose signifier parts had been changed artificially by the researcher, and asked to read them. See Appendix E for the reading list of pseudo-words.

**Condition 3**

In Condition 3, children were shown the same 15 words/characters with parts of them highlighted and asked to read them. See Appendix E for the Reading List of Highlighted Words.

**Materials**

* words, pseudo-words and highlighted words were written on 3" x 5" white index cards separately.

* videotape/audio tapes

**Task 4: Reading a Story Book**

In Task 4, a picture story book, 我的一天, wo de yi tian, 'My One Day' was chosen as a natural text with which to investigate young children's reading in context. The child was handed the book by the researcher backward and upside down and asked to read or pretend to read the book. After reading, the child was asked to retell the story to the researcher. Two sample pages of the story book--My One Day--are presented in Appendix E. In this story book, phonemic
symbols, i.e., ㄅ, ㄆ, ㄇ, ㄈ, and ㄉ, etc., are correspondently displayed beside each character.

These phonemic symbols are nationally used as a pronunciation aid in Taiwan. Publications for children in Taiwan, e.g., textbooks, newspapers, magazines, and books, etc., are required to display the phonemic symbols beside characters to indicate sound. In addition, in Taiwan, during the first ten weeks of the first school year, all of first graders receive intensive instruction on sounds and graphs of the phonemic symbols and the composition of the phonemic symbols and tones.

Task Sequence

1. Here is a book that has a story in it. I want you to look through the book and find out about the story. When you feel you are ready I want you to read or pretend to read the story to me.

2. Please retell the story to me.

Materials

* copy of 我的一天 (My One Day)
* videotape/audio tapes

Observing/Recording Procedures

Scheduling

Formal schooling instruction has been shown to affect children's literacy learning by Clay (1984); Deford (1985); Ferreiro (1982); and, Harste, Burke, and Woodward (1981, 1983). In order to investigate whether the effects of this instruction are similar across cultures and across writing systems, it was decided to wait until the end of
the first semester to begin data collection, with the expectation that most the first graders would have received instruction in reading and writing by this time. Thus, the data were collected during January and February, 1965.

The children were grouped into four groups of four or five, and each child was recorded for approximately one hour every day for four continuous days. The order and schedule of research tasks as well as data collection schedule are shown in Appendix E.

Observation

The researcher functioned as the task administrator for all subjects during the data collection procedures. All the tasks were administered individually to each child. One video tape machine and one tape recorder were used to record data. Two trained research assistants operated the video tape machine. All of a child's performances were recorded, including nonverbal gestures, body movements, facial expressions and reaction to material administered by the researcher and used by the subjects.

Recording Equipment

One video tape machine and one tape recorder were placed in the administering room. The tape recorder was to provide a supplement for the audio track from the video tape.

Transcriptions of the Tapes

After the four recording-observing periods, each of the video-audio tapes was transcribed by a trained research assistant within a 24 to 48 hour period, and checked by the researcher.
Development of The Coding Taxonomy

The development of the coding taxonomy for the oral and written protocols proceeded in three steps. In step 1, the inherent internal structure of Chinese orthography was analyzed through the conceptual analytic method in order to determine the lexical cues of the logographic writing system. The first step was fundamental and essential for further analysis (presented in Chapter Three). Consequently, in step 2, through the same analytic method a set of internal qualities of characters in early writing was elicited from the invented writing/spelling of the written protocols and the erroneous responses of the reading protocols. Then, in step 3, the taxonomy of the internal qualities of characters and the writing/spelling strategies of early writing were utilized to analyze the written protocols of Dictated Writing of Isolated Characters and Uninterrupted Writing. The taxonomy of the internal qualities of characters elicited from the data, and the three sets of cue categories originated from analyzing the internal structure of Chinese orthography were utilized to analyze the oral and written protocols of Reading and Dictated Writing of Isolated Characters/Words. The miscue analysis for reading (Goodman and Burke, 1972) was used in analyzing the transcripts of oral language from reading a story book. Taxonomies have been explained via the outline format under the following categories:

1. Taxonomy of Early Writing
2. Taxonomy of Reading and Dictated Writing of Isolated Words
3. Taxonomy of Reading a Story Book

**Coding Taxonomy of Early Writing**

The 19 Chinese children were asked to perform two types of writing—Uninterrupted Writing and Dictated Writing of Isolated Words. These 38 written protocols were analyzed to investigate writing/spelling strategies, patterns, and characteristics in early writing by Chinese-speaking children in a logographic writing system. In addition, the invented writing/spelling in both tasks and the erroneous responses in the task of Reading Isolated Words were concurrently analyzed to initiate a category, called internal qualities of characters, in order to identify the constructive patterns by Chinese-speaking children in the written mode. The definition, function, and example of these four sets of categories are delineated below.

1.0 The Mean Number of Characters, Component Parts and Strokes per Character: Describes the average number of characters and component parts and strokes in each character.

.1 **Number of Characters**
Describes how many characters were written in each task—Dictated Writing of Isolated Words, and Uninterrupted Writing. Name was not counted.

.2 **Average Component Parts per Character**
Coded only characters/invented characters

.3 **Average Strokes per Character**
Coded only characters/invented characters

2.0 Writing/spelling Strategies: Describes the strategies utilized to write/spell a character. (Multiple categories may be coded.)

.1 **Writing the Way It Sounds**
Including homonym characters and phonemic symbols writing.
Writing the Way It Looks

Using the manner of stroke attachment and the spatial composition of components to invent a character.

E.g., for 麗, lǐ, 'pretty'; 高 for 高, gāo, 'high'; and 心 for 心, xīn, 'heart'.

Writing the Way By Drawing

Drawing iconic picture or a picture.

E.g., 星 for 星, xīng, 'star'.

Using Last Name for Every Character/Word

Applying his/her last name on every character.

E.g., 周, zhōu, 'a last name'.

The Internal Qualities of Characters: The feature of a stroke, the manner of stroke attachment and the presence/absence of the first stroke are crucial for composing a character.

Stroke Contrast by Feature

Strokes contrast minimally by the presence or absence of distinguishing features.

E.g., | is vertical straight, | is left hook; — is horizontal straight, → is right hook.

Character Contrast by Strokes

Characters contrast minimally by the presence and/or absence of strokes.

E.g., 太, tài, 'too' in having an extra stroke, the dot, in the bottom inside; 我, wǒ, 'I' contrasts with 我, zhāo, 'search' in missing on stroke in the northwest corner.

The Manner of Stroke Attachment

Characters contrast by the manner of stroke attachment.

E.g., 天, tiān, 'sky' differs from 夫, fū, 'man' in the manner of stroke attachment of the first stroke; 今, jīn, 'noon' contrasts with 牛, niú, 'cow' in the manner of stroke attachment of the horizontal straight stroke.

The Developmental Patterns of Early Writing: Describes the developmental procedure of early writing in levels.
However, several levels might be involved at any one time. 
(Multiple categories are coded.)

.1 **Scribbling**
Making meaningless marks in paper

.2 **Using Last Name for Every Character/Word**

.3 **Iconic Pictographic Writing**
Drawing an iconic picture instead of writing 
e.g., for 星 (star); for 手 (hand); 
for 家 (home); for 牙 (teeth); etc.

.4 **Pictographic Invented Writing**
Combining strokes/stroke-like marks in a square frame, as 
well as using the manner of stroke attachment and the spatial composition of components to invent unrecognizable characters. 
e.g., for 洗; for 我; for 媽; etc.

.5 **Invented Writing with Mildly Distinguishable Qualities**
Using the manner of stroke attachment and the spatial composition of components to invent a recognizable character. 
e.g., for 床; for 手; for 牙; 
for 家; for 家; etc.

.6 **Invented Writing with Distinguishable Qualities**
The manner of stroke attachment and the spatial composition of components are utilized to construct a recognizable character. The figure of a character is highly distinguishable. The three subcategories are delineated below.

.6a **Improperly Positioned Characters**
Included upside down and/or mirror writing. 
e.g., for 大; for 小; for 媽.

.6b **Characters Consisting of a Similar Number and Figure of Components as Actual Characters**
Composing components of the invented character in different spatial places. 
e.g., for 爸.

.6c **Distinguishable Characters**
Noticeable use of the manner of stroke attachment and the spatial composition of components in writing. A character might be condensed or elaborated.
.7 Writing with Few Absent/Added Strokes or Wrong Strokes

* e.g., \text{找} for 我; 媽 for 媽; 爸 for 爸; etc.

.8 Writing by Homonym

Writing with the same pronunciation as another but with a different meaning and writing.

* e.g., 忠, zhōng, 'loyalty' for 中, zhōng, 'middle'; and 马, mǎ, 'horse' for 媽, mā, 'Mom'.

.9 Writing by Phonetic symbols

Writing with the same pronunciation as another but with Chinese phonemic symbols.

* e.g., 火 for 星, xīn, 'star'; 座 for 床, chuāng, 'bed'; and 洗, xi, for 洗, xi, 'wash'.

.10 Correct Writing

Coded when the written character was correct.

Coding Taxonomy of Reading and Dictated Writing of Isolated Words

Three sets of lexical cue categories originated from analyzing the internal structure of Chinese orthography; and the category of internal qualities of characters elicited from the data were utilized to analyze the oral and written data of Reading and Dictated Writing of Isolated Characters/Words. The three sets of cue systems representing the inherent constructive patterns of Chinese orthography are the number of strokes, the number of components, and the spatial figure of the character. Based on these three fundamental categories, the correct responses of the 19 subjects' oral and written protocols on the tasks of reading and Dictated Writing of Isolated Words were coded on the four sets of taxonomies—the number of strokes, the
number of components, and the spatical composition of components. The
erroneous responses of the 19 subjects' oral and written protocols
were also coded concurrently into the three categories stated above.
Furthermore, the internal qualities of characters representing the
character cues constructed by Chinese-speaking young children were
utilized to compare and contrast the target word and erroneous
responses word in oral and written modes. Consequently, the
systematic patterns of erroneous responses were extracted. The
definition, function, and unit/example of categories are delineated
below:

1.0 The Number of Strokes of Target Words: The number of
strokes of each character are counted by 12 basic strokes
described in the section of The Strokes of the Character,
Chapter Three.

1.1 3-5 Strokes
i.e., 大, 中, 手, 牙, 小, 天.

1.2 6-7 Strokes
i.e., 我, 年, 床.

1.3 8-9 Strokes
i.e., 苍, 星, 洗.

1.4 10-13 Strokes
i.e., 高, 家, 媽.

2.0 The Number of Components of Target Words: The character is
written in a square-frame. The frame is constructed by two
types of forms--singular and compound form. In compound
form a character is composed of two components which are
signifier and phonetic parts fundamentally. Most of the
phonetic parts are composed by more parts (see Chapter
Three). Therefore, most of the Chinese characters possess
multiple components visually.
One Component
i.e., 天, 中, 手, 牙, 小.

Two Components
i.e., 爸, 媽, 我, 星, 年, 洗, 天, 家, 床.

Four Components
i.e., 高.

3.0 The Spatial Composition of Components of Target Words: The compound form character occupies the components in vertical, horizontal or enclosure spatial positions (coded only for compound form characters).

Vertical Position
i.e., 爸, 高, 星, 年, 床, 家.

Horizontal Position
i.e., 媽, 我, 洗.

The taxonomy used to code the erroneous responses of oral and writing protocols is described below:

4.0 The Internal Qualities of Characters: The feature of a stroke, the manner of stroke attachment and the presence/absence of the first stroke are crucial for composing a character. (Stated in 3.0 of Coding Taxonomy of Early Writing)

5.0 Patterns of Erroneous Responses: Describes the patterns of error in responses (multiple code only for conditions 1, 2, and 3).

1. Having Similarity with Target Word
The erroneous responses contain the three internal qualities of character, i.e., Stroke Contrast by Feature, Character Contrast by Strokes, and The Manner of Stroke Attachment, e.g., 色, 'color' for 爸, bā, 'Dad'; and 智, zhì, 'bright' for 星, xīng, 'star'.

2. Utilizing Names in Word Recognition
Using his/her own last name, one of his/her first name, family members' and friends' names in word recognition,
Sound-Graphical Correspondence
One to one sound-graphic correspondence without any distinguishable features based on the category of internal qualities of characters. e.g., 頭 tōu, 'head' for 年 nēi, 'year'.

Sound-Graphical Noncorrespondence
The erroneous responses do not have one to one sound-graphic correspondence nor any distinguishable features. e.g., 小白兔 xiǎo-bái-tù, 'small white rabbit' for 我 wǒ, 'I'; and 小鳥 xiǎo-niǎo, 'small bird' for 年 nēi, 'year'.

Patterns of Similarity of Erroneous Responses: Further describes the patterns of error in the category of Having Similarity with Target Word (code only the category of Having Similarity with Target Word in Patterns of Erroneous Responses).

1. Having One Identical Component
The erroneous response contains one identical component with the target word. e.g., 色 (color) for 爸 (Dad); 明 (bright) for 星 (star); 象 (elephant) for 家 (home).

2. Having Similarity with Some Components
Some components of the erroneous word are relatively similar with the target word. e.g., 鴨 (duck) for 媽 (Mom); 牛 (cow) for 年 (year).

3. Having Distinguishing Features
The configuration of the erroneous word is relatively close to the target word based on the category of the three internal qualities of characters. e.g., 勾 (hook) for 我 (I); 克 (overcome) for 家 (Home).

4. Homonym
The erroneous response has the same pronunciation as the target word but with a different grapheme and meaning. e.g., 馬 mǎ, 'horse' for 媽 mā, 'Mom'.

E.g., 鳳 fēng, 'phoenix, a girl's first name' for 媽 mā, 'Mom'; 達 tà, 'a subject's last name' for 洗 xǐ, 'wash'; and 徐 xú, 'a subject's last name' for 我 wǒ, 'I'.
Coding Taxonomy of Reading a Story Book

In the Reading a Story Book Task three types of reading styles emerged from the data that were analyzed in order to categorize and understand young children's reading attitudes: Conventional Reading, Reading by Picture Cues, and Reading from Back Page. In sequence, the data in the first two categories of Reading Styles were coded into Yes or No in terms of Reading the Title Page.

Furthermore, the Miscue Analysis taxonomy, as set out in the Reading Miscue Inventory: Manual Procedure for Diagnosis and Evaluation, (Goodman and Burke, 1972) was adapted to analyze the narrative text of the subjects' data in the category of Conventional Reading.

In the RMI, no mention is made of deciding whether the material read is too difficult for the reader. The general suggestion is to use reading material one grade level above placement level in order to elicit sufficient "miscues" to complete the analysis. Also, not all "miscues" evidently needed to be recorded; instead one typically records and analyzes only the first 25 miscues elicited.

The researcher assessed the child's reading strategies by his/her success at getting at meaning and the quality of the strategies used. The errors the child made were a source of information for determining his/her strategies.

The five patterns of miscues marked on the narrative work sheet are substitutions, omissions, insertions, reversals, and repetition. Then, the nine reading miscue inventory questions as variables were
coded on the coding sheet to determine the reading strategies. The nine variables are dialect, intonation, graphic and sound similarity, grammatical function, correction, grammatical acceptability, semantic acceptability, and meaning change. Consequently, three reading categories are determined as sound/graphic relationships, grammatical relationships, and comprehension patterns. The narrative work sheet (in Chinese and English), the Reading Miscue Inventory Coding Sheet, and Reader Profile are displayed in Appendices B and E.

Analysis of the Data

The 19 subjects' language protocols were transcribed after each observation and used with the written protocols to fully develop the taxonomy for the strategies of associating sound, script and meaning used by this sample of Chinese-speaking children, for determining the cue systems used in early literacy access in character level. In addition, the miscue analysis for reading (Goodman and Burke, 1972) was adapted to analyze the data of the children's reading. Both the correct and erroneous responses of the children were fully used in developing the taxonomies, since the goal is to understand the strategies of the developmental procedure, to explain the conceptualization processes of writing and reading and consequently to understand what the linguistic components in the Chinese logographic system are which could serve as the cues for the beginning learners. The coding taxonomies were fully presented above.

Possible lexical cues inherent in Chinese orthography have been initially determined through analyzing the internal constructive
principles of Chinese orthography by the researcher as the fundamental linguistic task for analyzing the language data (presented in Chapter Three). The cues identified are the strokes of the character, the component parts of the character, and the spatial figure of the component parts.

The analysis procedure was analytic-inductive. The researcher started by organizing the data into analytic categories through a conceptual analysis method which proceeded according to steps detailed by Tesch (1980) as well as by Bogdan and Biklen (1982). The method is briefly described as follows:

Step 1: **Advance organizers**

The protocols were sorted into certain themes first according to the organizing ideas and research questions which were segments of expression dealing with certain themes. All themes, called *principles*, were listed and then ordered according to their internal logic or frequency.

Step 2: **Organize data under principles**

The task was to study each theme intensively and to determine what it was that the subjects were saying and doing about it. Each theme received the same treatment until the relevant material related to the advance organizers was exhausted.

Step 3: **Search for themes within each organizer**

The above procedure was repeated for the material within each additional organizer.
Step 4: Develop categories

The researcher now had a list of themes which was probably a bit larger than the list of advance organizers, and also information about the substance of each theme, i.e., how many different strategies and responses there were and which ones seemed to be prevalent. The themes were compared with each other to see if some were enough like each other in content, so that they might be reasonably grouped together. Once the themes were grouped according to their substance, categories/patterns were obtained.

The transcribed oral protocols and written protocols were coded in terms of categories/patterns. The tabulated frequency and percentages of children’s responses in written mode provided a means for comparison within the category/pattern and among the different situations and ages. The quantitative references were more for providing an idea about the frequency of a specific kind of response than for making a statistical evaluation. Data for analysis were from four tasks and analyzed into three taxonomies in terms of early reading and writing in order to understand the cue systems and the constructive patterns of early literacy in character level simultaneously and holistically. The design of the study was presented in Appendix A. Each finding was drawn from each taxonomy. Then the overall discussion was integratively drawn from the findings to answer the research questions.
CHAPTER FIVE
ANALYSIS OF THE DATA

Transcripts of oral language from the tasks of Reading Isolated Words and Reading a Story Book, and the original writing protocols from the tasks of Dictated Writing of Isolated Words and Uninterrupted Writing were analyzed to determine the cues and strategies utilized in early reading and writing on the character level by Chinese-speaking children.

All oral and written protocols were coded in taxonomies for comparisons within the category of patterns and among the different situations. The taxonomy of early writing was used to analyze Dictated Writing of Isolated Words/Characters and Uninterrupted Writing. The taxonomy of Reading and Dictated Writing of Isolated Words/Characters was used to analyze the oral and written data from Reading and Dictated Writing of Isolated Words/Characters. The taxonomy of miscue analysis was used to analyze the data from Reading a Story Book. These three taxonomies were described in Chapter Four.

The number and percentage of children per category was tabulated by age and task. Frequencies, percentages and means were calculated. Comparisons were drawn among tasks, modes, and ages in each category.
The transcripts of oral responses and the original writing protocols collected from the four tasks and coded in the three sets of taxonomies were analyzed and are presented in three findings categories following the taxonomy—Finding One: Early Writing, Finding Two: Reading and Writing of Isolated Words, and Finding Three: Reading a Story Book. The overall findings are presented to address questions regarding the cues, strategies and characteristics of the development of early reading and writing in Chinese speaking/writing children.

**Early Writing**

The data from the tasks of Dictated Writing of Isolated Words and Uninterrupted Writing were simultaneously and descriptively analyzed into three categories, i.e., the Mean Number of Characters, Component Parts and Strokes Per Character, Writing/Spelling Strategies and Developmental Patterns of Early Writing in Lexicon, in order to understand the strategies, cues and erroneous patterns Chinese-speaking children utilized in early writing. Differences among tasks and ages are presented.

On the task of Dictated Writing of Isolated Words only one three-year-old boy produced undifferentiated scribble. On the task of Uninterrupted Writing the same three-year-old also produced undifferentiated scribble. All others produced either characters, character-like words, their own names, or Arabic numbers. When children were asked to read what they had written, all of them except the scribbler read or pretended to read what they had written.
The Mean Number of Characters, Component Parts and Strokes per Character

As reported on Table 2, the average number of characters written by the 19 subjects in this study was noticeably different between different writing situations. In the more free writing situation, i.e., Uninterrupted Writing, the average was 23.79; and in the test-like controlled situation, i.e., Dictated Writing of Isolated Words, the average was down to 8.84 which was almost half of the average target words. The mean number of component parts per character was 1.44 across the writing modes and was not much different between the two writing modes. The mean number of strokes per character was 4.54 across the two writing modes and also was not much different between the two writing modes.

The data reveal that the mean number of strokes per character in this study of young writers (4.54) was quite a bit lower than the 11.27 reported in Leong's study of adult writers. In addition, the data show that existence of a more free writing situation increases the number of characters.
TABLE 2
MEAN OF THE NUMBER OF CHARACTERS, COMPONENT PARTS AND STROKE
PER CHARACTER WRITTEN BY SUBJECTS ACROSS WRITING MODES

<table>
<thead>
<tr>
<th>Category</th>
<th>Dictated Writing</th>
<th>Uninterrupted Writing</th>
<th>Average Across Modes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Characters</td>
<td>8.84</td>
<td>23.79</td>
<td>16.32</td>
</tr>
<tr>
<td>Component Parts per Character</td>
<td>1.59</td>
<td>1.28</td>
<td>1.44</td>
</tr>
<tr>
<td>Strokes per Character</td>
<td>4.72</td>
<td>4.36</td>
<td>4.54</td>
</tr>
</tbody>
</table>
The Mean Number of Characters, Component Parts and Strokes per Character by Age. As reported on Table 3, comparisons of the mean number of characters written correctly by subjects across two writing modes by age show that the older the children were, the more characters they wrote correctly across writing situations (in Dictated Writing of Isolated Words: age three, 1; age four, 2; age five, 2.33; age six, 8.8; and in Uninterrupted Writing: age three, 1.25; age four, 3.5; age five, 6.5; age six, 53.0). In addition, the average characters written correctly by the subjects in Uninterrupted Writing situation was 4.62 times greater than it was in Dictated Writing situation.
## TABLE 3

**FREQUENCY AND AVERAGE OF CHARACTERS WRITTEN CORRECTLY ACROSS WRITTEN MODES BY AGES**

<table>
<thead>
<tr>
<th>Age</th>
<th>Dictated Writing</th>
<th></th>
<th>Uninterrupted Writing</th>
<th></th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency of Characters</td>
<td>Average Characters Per Subject</td>
<td>Frequency of Characters</td>
<td>Average Characters Per Subject</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age 3</td>
<td>4</td>
<td>1.00</td>
<td>5</td>
<td>1.25</td>
<td>1: 1.25</td>
</tr>
<tr>
<td>Age 4</td>
<td>8</td>
<td>2.00</td>
<td>14</td>
<td>3.50</td>
<td>1: 1.75</td>
</tr>
<tr>
<td>Age 5</td>
<td>14</td>
<td>2.33</td>
<td>39</td>
<td>6.50</td>
<td>1: 2.79</td>
</tr>
<tr>
<td>Age 6</td>
<td>44</td>
<td>8.80</td>
<td>265</td>
<td>53.00</td>
<td>1: 6.02</td>
</tr>
<tr>
<td>Average Across Ages</td>
<td>70</td>
<td>3.68</td>
<td>323</td>
<td>17.00</td>
<td>1: 4.62</td>
</tr>
</tbody>
</table>
As reported on Tables 4 and 5, the data show that the younger the children were, except age six, the more characters they took risks to write in Dictated Writing of Isolated Words Task. The existence of the 20.25 mean for four-year-olds in Uninterrupted Writing was accounted for by one subject who wrote a large number of characters. In addition, the data also reveal that in general children wrote characters correctly more in the free writing situation, i.e., Uninterrupted Writing, than in the test-like situation, i.e., Dictated Writing of Isolated Words.
### Table 4

**Comparison of Average Characters Written by Subjects with Target Characters Across Ages in Dictated Writing**

<table>
<thead>
<tr>
<th>Age</th>
<th>Average Target Words Per Subject</th>
<th>Average Characters Written Per Subject</th>
<th>Average Characters Written Correctly Per Subject</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>15</td>
<td>9.50</td>
<td>1.00</td>
<td>1.58:1:0.11</td>
</tr>
<tr>
<td>4</td>
<td>15</td>
<td>8.50</td>
<td>2.00</td>
<td>1.76:1:0.24</td>
</tr>
<tr>
<td>5</td>
<td>15</td>
<td>7.33</td>
<td>2.33</td>
<td>2.05:1:0.32</td>
</tr>
<tr>
<td>6</td>
<td>15</td>
<td>10.40</td>
<td>8.80</td>
<td>1.44:1:0.85</td>
</tr>
<tr>
<td>Average Across Ages</td>
<td>15</td>
<td>8.84</td>
<td>3.68</td>
<td>1.70:1:0.42</td>
</tr>
</tbody>
</table>

### Table 5

**Average Characters Written by Subjects Across Ages in Uninterrupted Writing**

<table>
<thead>
<tr>
<th>Age</th>
<th>Average Characters Written Per Subject</th>
<th>Average Characters Written Correctly Per Subject</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>7.00</td>
<td>1.25</td>
<td>1: 0.18</td>
</tr>
<tr>
<td>4</td>
<td>20.25</td>
<td>3.50</td>
<td>1: 0.17</td>
</tr>
<tr>
<td>5</td>
<td>8.83</td>
<td>6.50</td>
<td>1: 0.74</td>
</tr>
<tr>
<td>6</td>
<td>58.00</td>
<td>53.00</td>
<td>1: 0.91</td>
</tr>
<tr>
<td>Average Across Ages</td>
<td>23.79</td>
<td>17.00</td>
<td>1: 0.71</td>
</tr>
</tbody>
</table>
As reported on Table 6, comparison of the mean number of component parts per character by age across writing modes shows a small developmental differences among ages, but no large differences between writing situations. The existence of the 2.41 mean for four-year-olds on Dictated Writing is accounted for by one subject who used characters with a disproportionately large number of component parts. Further, as reported on Table 7, comparison of the mean number of strokes per character by age across the two writing modes reveals the existence of a developmental leap particularly between the ages of five and six across the two writing modes (in Dictated Writing, from 4.10 to 6.96; in Uninterrupted Writing, from 4.72 to 7.22).
### TABLE 6

**AVERAGE OF THE NUMBER OF COMPONENT PARTS PER CHARACTER**

**WRITTEN BY SUBJECTS ACROSS WRITING MODES BY AGES**

<table>
<thead>
<tr>
<th>Age</th>
<th>Target Words Per Subject</th>
<th>Dictated Writing Per Subject</th>
<th>Uninterrupted Writing Per Subject</th>
<th>Average Across Modes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age 3</td>
<td>1.8</td>
<td>0.86</td>
<td>0.85</td>
<td>0.86</td>
</tr>
<tr>
<td>Age 4</td>
<td>1.8</td>
<td>2.41</td>
<td>1.27</td>
<td>1.84</td>
</tr>
<tr>
<td>Age 5</td>
<td>1.8</td>
<td>1.27</td>
<td>1.22</td>
<td>1.25</td>
</tr>
<tr>
<td>Age 6</td>
<td>1.8</td>
<td>1.80</td>
<td>1.77</td>
<td>1.79</td>
</tr>
<tr>
<td>Average Across Age</td>
<td>1.8</td>
<td>1.59</td>
<td>1.28</td>
<td>1.44</td>
</tr>
</tbody>
</table>

### TABLE 7

**AVERAGE OF THE NUMBER OF STROKES PER CHARACTER**

**WRITTEN BY SUBJECTS ACROSS WRITING MODES BY AGES**

<table>
<thead>
<tr>
<th>Age</th>
<th>Target Words Per Subject</th>
<th>Dictated Writing Per Subject</th>
<th>Uninterrupted Writing Per Subject</th>
<th>Average Across Modes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age 3</td>
<td>6.73</td>
<td>3.10</td>
<td>2.69</td>
<td>2.90</td>
</tr>
<tr>
<td>Age 4</td>
<td>6.73</td>
<td>4.72</td>
<td>2.79</td>
<td>3.76</td>
</tr>
<tr>
<td>Age 5</td>
<td>6.73</td>
<td>4.10</td>
<td>4.72</td>
<td>4.41</td>
</tr>
<tr>
<td>Age 6</td>
<td>6.73</td>
<td>6.96</td>
<td>7.22</td>
<td>7.09</td>
</tr>
<tr>
<td>Average Across Age</td>
<td>6.73</td>
<td>4.72</td>
<td>4.36</td>
<td>4.54</td>
</tr>
</tbody>
</table>
Writing/Spelling Strategies

As reported on Tables 8, 9, and 10, the phonetic strategy, that is, the use of the phonemic symbols to spell out the sound of a character and/or the use of homonym character, was used by 10.5% of the subjects on the task of Dictated Writing of Isolated Words and 15.8% in Uninterrupted Writing. The lexical visual strategy, that is writing a character the way it looks, was utilized by 52.6% of the subjects in Dictated Writing of Isolated Words and 57.9% in Uninterrupted Writing. The drawing strategy, that is writing a character by drawing a iconic picture, was applied by 15.8% of the subjects in Dictated Writing of Isolated Words and 5.3% in Uninterrupted Writing. The strategy of using last name for every word was applied by 5.3% of the subjects on both the tasks. Overall, the utilized rated order by the subjects was the visual strategy (55.3%), then, the phonetic strategy (13.2%), the drawing strategy (10.5%), and using last name for every word (5.3%).
<table>
<thead>
<tr>
<th>Strategy Category</th>
<th>Dictated Writing</th>
<th></th>
<th>Uninterrupted Writing</th>
<th></th>
<th>Subtotal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n= 19</td>
<td>F</td>
<td>%</td>
<td></td>
<td>n= 19</td>
</tr>
<tr>
<td>Writing The Way It Sounds</td>
<td>2</td>
<td>10.5</td>
<td>3</td>
<td>15.8</td>
<td>5</td>
</tr>
<tr>
<td>Writing The Way It Looks</td>
<td>10</td>
<td>52.6</td>
<td>11</td>
<td>57.9</td>
<td>21</td>
</tr>
<tr>
<td>Drawing</td>
<td>3</td>
<td>15.8</td>
<td>1</td>
<td>5.3</td>
<td>4</td>
</tr>
<tr>
<td>Using Last Name For Every Word</td>
<td>1</td>
<td>5.3</td>
<td>1</td>
<td>5.3</td>
<td>2</td>
</tr>
<tr>
<td>Total*</td>
<td>16</td>
<td></td>
<td>16</td>
<td></td>
<td>32</td>
</tr>
</tbody>
</table>

* Note: Totals exceed n since multiple strategies were used on some protocols.
### TABLE 9
FREQUENCY AND PERCENTAGE OF WRITING/SPELLING STRATEGIES
BY RESPONDENT IN EARLY WRITING IN DICTATED WRITING

<table>
<thead>
<tr>
<th>Strategy Category</th>
<th>Frequency of Subjects</th>
<th>% of Subjects</th>
<th>Frequency of Characters</th>
<th>Average Character Per Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>Writing The Way It Sounds</td>
<td>2</td>
<td>10.5</td>
<td>10</td>
<td>5.0</td>
</tr>
<tr>
<td>Writing The Way It Looks</td>
<td>10</td>
<td>52.6</td>
<td>29</td>
<td>2.9</td>
</tr>
<tr>
<td>Drawing</td>
<td>1</td>
<td>5.3</td>
<td>4</td>
<td>4.0</td>
</tr>
<tr>
<td>Using Last Name For Every Word</td>
<td>3</td>
<td>15.8</td>
<td>9</td>
<td>3.0</td>
</tr>
</tbody>
</table>

### TABLE 10
FREQUENCY AND PERCENTAGE OF WRITING/SPELLING STRATEGIES
BY RESPONDENT IN EARLY WRITING IN UNINTERRUPTED WRITING

<table>
<thead>
<tr>
<th>Strategy Category</th>
<th>Frequency of Subjects</th>
<th>% of Subjects</th>
<th>Frequency of Characters</th>
<th>Average Character Per Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>Writing The Way It Sounds</td>
<td>3</td>
<td>15.8</td>
<td>50</td>
<td>16.7</td>
</tr>
<tr>
<td>Writing The Way It Looks</td>
<td>11</td>
<td>57.9</td>
<td>22</td>
<td>2.0</td>
</tr>
<tr>
<td>Drawing</td>
<td>1</td>
<td>5.3</td>
<td>3</td>
<td>3.0</td>
</tr>
<tr>
<td>Using Last Name For Every Word</td>
<td>1</td>
<td>5.3</td>
<td>5</td>
<td>5.0</td>
</tr>
</tbody>
</table>
Writing/Spelling Strategies by Age  As reported on Tables 11 and 12, the phonetic strategy was utilized only by the six-year-olds across writing modes (40% and 60%). The children across ages tended to prefer visual strategy which was employed in different degrees in different writing modes. One five-year-old boy in this study kept consistently drawing to represent some characters across modes. One three-year-old girl also kept consistently writing her last name for every character in the two writing modes. Two three-year-old subjects applied the drawing strategy only in the Dictated Writing of Isolated Words.
Table 11

Frequency and percentage of writing/spelling strategies by respondent in early writing across ages in dictated writing

<table>
<thead>
<tr>
<th>Strategy Category</th>
<th>Age 3</th>
<th>Age 4</th>
<th>Age 5</th>
<th>Age 6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n= 4</td>
<td>n= 4</td>
<td>n= 6</td>
<td>n= 5</td>
</tr>
<tr>
<td></td>
<td>F %</td>
<td>F %</td>
<td>F %</td>
<td>F %</td>
</tr>
<tr>
<td>Writing The Way It Sounds</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Writing The Way It Looks</td>
<td>2.0</td>
<td>50.0</td>
<td>1.0</td>
<td>25.0</td>
</tr>
<tr>
<td>Drawing</td>
<td>2.0</td>
<td>50.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Using Last Name For Every Word</td>
<td>1.0</td>
<td>25.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Total*</td>
<td>5.0</td>
<td>1.0</td>
<td>6.0</td>
<td>4.0</td>
</tr>
</tbody>
</table>

* Note: Totals exceed n since multiple strategies were used on some protocols.
### TABLE 12

**FREQUENCY AND PERCENTAGE OF WRITING/SPELLING STRATEGIES**

BY RESPONDENT IN EARLY WRITING ACROSS AGES IN UNINTERRUPTED WRITING

<table>
<thead>
<tr>
<th>Strategy Category</th>
<th>Age 3</th>
<th>Age 4</th>
<th>Age 5</th>
<th>Age 6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n= 3</td>
<td>n= 4</td>
<td>n= 6</td>
<td>n= 5</td>
</tr>
<tr>
<td></td>
<td>F %</td>
<td>F %</td>
<td>F %</td>
<td>F %</td>
</tr>
<tr>
<td>Writing The Way It Sounds</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Writing The Way It Looks</td>
<td>25.0</td>
<td>50.0</td>
<td>66.7</td>
<td>80.0</td>
</tr>
<tr>
<td>Drawing</td>
<td>0.0</td>
<td>0.0</td>
<td>16.7</td>
<td>0.0</td>
</tr>
<tr>
<td>Using Last Name For Every Word</td>
<td>25.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>Total</strong>*</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>7</td>
</tr>
</tbody>
</table>

* Note: Totals exceed n since multiple strategies were used on some protocols.
Developmental Patterns of Early Writing in Lexicon

Ten levels of developmental patterns of early writing in lexicon emerged from 19 subjects' writing protocols from two different writing situations. These levels were defined in Chapter Four. As reported on Tables 13, 14, and 15, comparisons of frequencies and percentages by pattern for different writing modes reveal consistent developmental patterns between the two modes except for the pattern of Writing by Phonetic Symbol. The highest level, Correct Writing, had the highest percentage in the two modes (78.9% and 78.9%); the second highest level was Invented Writing with Distinguishable Qualities; the third one was Writing With FewAbsent/Added Strokes. The lowest developmental patterns, Scribbling and Using Last Name for Every Character/Word, had the lowest rate.
TABLE 13
FREQUENCY AND PERCENTAGE OF DEVELOPMENTAL PATTERNS
BY RESPONDENT IN EARLY WRITING IN LEXICON ACROSS WRITING MODES

<table>
<thead>
<tr>
<th>Level Of Developmental Patterns</th>
<th>Dictated Writing n= 19</th>
<th>Uninterrupted Writing n= 19</th>
<th>Subtotal n= 38</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scribbling</td>
<td>1 5.3</td>
<td>1 5.3</td>
<td>2 5.3</td>
</tr>
<tr>
<td>Using Last Name For Every Word</td>
<td>1 5.3</td>
<td>1 5.3</td>
<td>2 5.3</td>
</tr>
<tr>
<td>Iconic Pictographic Writing</td>
<td>4 21.1</td>
<td>1 5.3</td>
<td>5 13.2</td>
</tr>
<tr>
<td>Pictographic Invented Writing</td>
<td>5 26.3</td>
<td>4 21.1</td>
<td>9 23.7</td>
</tr>
<tr>
<td>Invented Writing With Mildly Distinguishable Qualities</td>
<td>2 10.5</td>
<td>1 5.3</td>
<td>3 7.9</td>
</tr>
<tr>
<td>Invented Writing With Distinguishable Qualities</td>
<td>12 63.2</td>
<td>10 52.6</td>
<td>22 57.9</td>
</tr>
<tr>
<td>Writing With Few Absent/Added Strokes</td>
<td>6 31.6</td>
<td>7 36.8</td>
<td>13 34.2</td>
</tr>
<tr>
<td>Writing By Homonym Character</td>
<td>2 10.5</td>
<td>1 5.3</td>
<td>3 7.9</td>
</tr>
<tr>
<td>Writing By Phonemic Symbol</td>
<td>2 10.5</td>
<td>3 15.8</td>
<td>5 13.2</td>
</tr>
<tr>
<td>Correct Writing</td>
<td>15 78.9</td>
<td>15 78.9</td>
<td>30 78.9</td>
</tr>
<tr>
<td>Total*</td>
<td>50</td>
<td>44</td>
<td>94</td>
</tr>
</tbody>
</table>

* Note: Totals exceed n since multiple strategies were used on some protocols.
TABLE 14
FREQUENCY AND PERCENTAGE OF DEVELOPMENTAL PATTERNS
BY RESPONDENT IN EARLY WRITING IN LEXICON IN DICTATED WRITING

<table>
<thead>
<tr>
<th>Level of Developmental Patterns</th>
<th>Frequency of Subjects</th>
<th>% of Subjects</th>
<th>Frequency of Characters</th>
<th>Average Character Per Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scribbling</td>
<td>1</td>
<td>5.3</td>
<td>3</td>
<td>3.0</td>
</tr>
<tr>
<td>Using Last Name For Every Word</td>
<td>1</td>
<td>5.3</td>
<td>4</td>
<td>4.0</td>
</tr>
<tr>
<td>Iconic Pictographic Writing</td>
<td>4</td>
<td>21.1</td>
<td>11</td>
<td>2.8</td>
</tr>
<tr>
<td>Pictographic Invented Writing</td>
<td>5</td>
<td>26.3</td>
<td>45</td>
<td>9.0</td>
</tr>
<tr>
<td>Invented Writing With Mildly Distinguishable Qualities</td>
<td>2</td>
<td>10.5</td>
<td>14</td>
<td>7.0</td>
</tr>
<tr>
<td>Invented Writing With Distinguishable Qualities</td>
<td>12</td>
<td>63.2</td>
<td>26</td>
<td>2.2</td>
</tr>
<tr>
<td>Writing With Few Absent/Added Strokes</td>
<td>6</td>
<td>31.6</td>
<td>9</td>
<td>1.5</td>
</tr>
<tr>
<td>Writing By Homonym Character</td>
<td>2</td>
<td>10.5</td>
<td>2</td>
<td>1.0</td>
</tr>
<tr>
<td>Writing By Phonemic Symbol</td>
<td>2</td>
<td>10.5</td>
<td>9</td>
<td>4.5</td>
</tr>
<tr>
<td>Correct Writing</td>
<td>15</td>
<td>78.9</td>
<td>70</td>
<td>4.7</td>
</tr>
</tbody>
</table>
### Table 15

FREQUENCY AND PERCENTAGE OF DEVELOPMENTAL PATTERNS BY RESPONDENT IN EARLY WRITING IN LEXICON IN UNINTERRUPTED WRITING

<table>
<thead>
<tr>
<th>Level of Developmental Patterns</th>
<th>Frequency of Subjects</th>
<th>% of Subjects n=19</th>
<th>Frequency of Characters</th>
<th>Average Character Per Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scribbling</td>
<td>1</td>
<td>5.3</td>
<td>20</td>
<td>20.0</td>
</tr>
<tr>
<td>Using Last Name For Every Word</td>
<td>1</td>
<td>5.3</td>
<td>5</td>
<td>5.0</td>
</tr>
<tr>
<td>Iconic Pictographic Writing</td>
<td>1</td>
<td>5.3</td>
<td>3</td>
<td>3.0</td>
</tr>
<tr>
<td>Pictographic Invented Writing</td>
<td>4</td>
<td>21.1</td>
<td>50</td>
<td>12.5</td>
</tr>
<tr>
<td>Invented Writing With Mildly Distinguishable Qualities</td>
<td>1</td>
<td>5.3</td>
<td>1</td>
<td>1.0</td>
</tr>
<tr>
<td>Invented Writing With Distinguishable Qualities</td>
<td>10</td>
<td>52.6</td>
<td>35</td>
<td>3.5</td>
</tr>
<tr>
<td>Writing With Few Absent/Added Strokes</td>
<td>7</td>
<td>36.8</td>
<td>9</td>
<td>1.3</td>
</tr>
<tr>
<td>Writing By Homonym Character</td>
<td>1</td>
<td>5.3</td>
<td>4</td>
<td>4.0</td>
</tr>
<tr>
<td>Writing By Phonemic Symbol</td>
<td>3</td>
<td>15.8</td>
<td>51</td>
<td>17.0</td>
</tr>
<tr>
<td>Correct Writing</td>
<td>15</td>
<td>78.9</td>
<td>323</td>
<td>21.5</td>
</tr>
</tbody>
</table>
Developmental Patterns of Early Writing in Lexicon by Age

As reported on Tables 16 and 17, comparisons of frequencies and percentages by developmental patterns across ages shown in the samples in the two writing modes reveal notable differences among three-, four-, five-, and six-year-olds. The older the children were, the higher were the levels of developmental patterns in lexicon presented. Interestingly, these data indicate that the older the children were, the less risks they took to invent writing/spelling. The five six-year-olds in this study rarely took risks to utilize the internal qualities of characters, i.e., the manner of stroke attachment, character contrast by strokes, and stroke contrast by figures, to invent characters. In contrast, they utilized the strategy of using phonemic symbols learned in school to spell characters they could sound but could not write (40% in Dictated Writing and 60% in Uninterrupted Writing). None of three- and four-year-olds wrote by using a homonym character, while one out of six subjects in the age five group wrote using a homonym character in the mode of Dictated Writing of Isolated Words.
<table>
<thead>
<tr>
<th>Level of Developmental Patterns</th>
<th>Age 3 (n=4)</th>
<th>Age 4 (n=4)</th>
<th>Age 5 (n=6)</th>
<th>Age 6 (n=5)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>%</td>
<td>F</td>
<td>%</td>
</tr>
<tr>
<td>Scribbling</td>
<td>1</td>
<td>25.0</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Using Last Name For Every Word</td>
<td>1</td>
<td>25.0</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Iconic Pictographic Writing</td>
<td>2</td>
<td>50.0</td>
<td>1</td>
<td>25.0</td>
</tr>
<tr>
<td>Pictographic Invented Writing</td>
<td>2</td>
<td>50.0</td>
<td>2</td>
<td>50.0</td>
</tr>
<tr>
<td>Invented Writing With Mildly Distinguishable Qualities</td>
<td>1</td>
<td>25.0</td>
<td>1</td>
<td>25.0</td>
</tr>
<tr>
<td>Invented Writing With Distinguishable Qualities</td>
<td>2</td>
<td>50.0</td>
<td>2</td>
<td>50.0</td>
</tr>
<tr>
<td>Writing With Few Absent/Added Strokes</td>
<td>1</td>
<td>25.0</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Writing By Homonym Character</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Writing By Phonemic Symbol</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Correct Writing</td>
<td>2</td>
<td>50.0</td>
<td>3</td>
<td>75.0</td>
</tr>
<tr>
<td>Total*</td>
<td>12</td>
<td>9</td>
<td>15</td>
<td>14</td>
</tr>
</tbody>
</table>

* Note: Totals exceed n since multiple strategies were used on some protocols.
### TABLE 17

**FREQUENCY AND PERCENTAGE OF DEVELOPMENTAL PATTERNS BY RESPONDENT IN EARLY WRITING IN LEXICON ACROSS AGES IN UNINTERRUPTED WRITING**

<table>
<thead>
<tr>
<th>Level of Developmental Patterns</th>
<th>Age 3 n= 4</th>
<th>Age 4 n= 4</th>
<th>Age 5 n= 6</th>
<th>Age 6 n= 5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F %</td>
<td>F %</td>
<td>F %</td>
<td>F %</td>
</tr>
<tr>
<td>Scribbling</td>
<td>1 25.0</td>
<td>0 0.0</td>
<td>0 0.0</td>
<td>0 0.0</td>
</tr>
<tr>
<td>Using Last Name For Every Word</td>
<td>1 25.0</td>
<td>0 0.0</td>
<td>0 0.0</td>
<td>0 0.0</td>
</tr>
<tr>
<td>Iconic Pictographic Writing</td>
<td>0 0.0</td>
<td>0 0.0</td>
<td>1 16.7</td>
<td>0 0.0</td>
</tr>
<tr>
<td>Pictographic Invented Writing</td>
<td>1 25.0</td>
<td>3 75.0</td>
<td>0 0.0</td>
<td>0 0.0</td>
</tr>
<tr>
<td>Invented Writing With Mildly Distinguishable Qualities</td>
<td>0 0.0</td>
<td>1 25.0</td>
<td>0 0.0</td>
<td>0 0.0</td>
</tr>
<tr>
<td>Invented Writing With Distinguishable Qualities</td>
<td>2 50.0</td>
<td>3 75.0</td>
<td>4 66.7</td>
<td>1 20.0</td>
</tr>
<tr>
<td>Writing With Few Absent/Added Strokes</td>
<td>1 25.0</td>
<td>1 25.0</td>
<td>1 16.7</td>
<td>4 80.0</td>
</tr>
<tr>
<td>Writing By Homonym Character</td>
<td>0 0.0</td>
<td>0 0.0</td>
<td>0 0.0</td>
<td>1 20.0</td>
</tr>
<tr>
<td>Writing By Phonemic Symbol</td>
<td>0 0.0</td>
<td>0 0.0</td>
<td>0 0.0</td>
<td>3 60.0</td>
</tr>
<tr>
<td>Correct Writing</td>
<td>2 50.0</td>
<td>3 75.0</td>
<td>5 83.3</td>
<td>5 80.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>8</td>
<td>11</td>
<td>11</td>
<td>14</td>
</tr>
</tbody>
</table>

*Note: Totals exceed n since multiple strategies were used on some protocols.*
Sub-patterns in the Level of Invented Writing with Distinguishable Qualities

The developmental pattern of Invented Writing with Distinguishable Qualities was analyzed in terms of three sub-patterns: Improperly Positioned Characters, such as upside-down characters or mirror writing; Characters Consisting of a Similar Number and Figure of Components as actual characters; and Distinguishable Characters, those having a manner of stroke attachment and the spatial composition of the components that highly resembles the actual characters. These three sub-patterns that emerged from the data are distinct from another general developmental pattern—Invented Writing with Mildly Distinguishable Qualities.

As reported on Tables 18, 19, and 20, the samples of 52.6% of the 19 subjects in this study presented the pattern of Distinguishable Characters in the mode of Dictated Writing, and 42.1% in Uninterrupted Writing. The data show that on the samples of Dictated Writing, the 21.1% of the responses showed that subjects in this study were confused about the position of the character, i.e., upside-down and/or mirror writing. On the samples of Uninterrupted Writing, 31.6% of the responses showed this pattern. The use of Characters Consisting of a Similar Number and Figure of Components as actual characters had the lowest rate across the writing modes (5.3% and 5.3%). Comparisons of frequencies and percentages by sub-developmental patterns across writing modes reveal a consistent pattern in utilizing visual features to invent distinguishable characters.
TABLE 18

FREQUENCY AND PERCENTAGE OF SUB-PATTERNS BY RESPONDENT
IN THE LEVEL OF INVENTED WRITING WITH DISTINGUISHABLE QUALITIES
ACROSS WRITING MODES

<table>
<thead>
<tr>
<th>Sub-Patterns</th>
<th>Dictated Writing</th>
<th>Uninterrupted Writing</th>
<th>Subtotal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n= 19</td>
<td>n= 19</td>
<td>n= 38</td>
</tr>
<tr>
<td></td>
<td>F    %</td>
<td>F    %</td>
<td>F    %</td>
</tr>
<tr>
<td>Improperly Positioned Characters</td>
<td>4    21.1</td>
<td>6    31.6</td>
<td>10       26.3</td>
</tr>
<tr>
<td>Characters Consisting of a Similar Number and Figure of Components as Actual Characters</td>
<td>1    5.3</td>
<td>1    5.3</td>
<td>2        5.3</td>
</tr>
<tr>
<td>Distinguishable Characters</td>
<td>10   52.6</td>
<td>8    42.1</td>
<td>18       47.4</td>
</tr>
<tr>
<td>Total</td>
<td>15</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td>Sub-Patterns</td>
<td>Frequency of Subjects</td>
<td>% of Subjects</td>
<td>Frequency of Characters</td>
</tr>
<tr>
<td>------------------------------------------</td>
<td>-----------------------</td>
<td>---------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>Improperly Positioned Characters</td>
<td>4</td>
<td>21.1</td>
<td>6</td>
</tr>
<tr>
<td>Characters Consisting of a Similar Number and Figure of Components as Actual Characters</td>
<td>1</td>
<td>5.3</td>
<td>1</td>
</tr>
<tr>
<td>Distinguishable Characters</td>
<td>10</td>
<td>52.6</td>
<td>19</td>
</tr>
<tr>
<td>Sub-Patterns</td>
<td>Frequency of Subjects</td>
<td>% of Subjects</td>
<td>Frequency of Characters</td>
</tr>
<tr>
<td>--------------------------------------------------</td>
<td>-----------------------</td>
<td>---------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>Improperly Positioned Characters</td>
<td>6</td>
<td>31.6</td>
<td>17</td>
</tr>
<tr>
<td>Characters Consisting of a Similar Number and Figure of Components as Actual Characters</td>
<td>1</td>
<td>5.3</td>
<td>1</td>
</tr>
<tr>
<td>Distinguishable Characters</td>
<td>8</td>
<td>42.1</td>
<td>15</td>
</tr>
</tbody>
</table>
Reading and Dictated Writing of Isolated Words

The data on the task of Reading Isolated Words in three conditions—Reading Words, Reading Pseudo-words, and Reading Highlighted Words, and the task of Dictated Writing of Isolated Words were simultaneously analyzed in terms of the correct and erroneous responses in order to holistically understand the possible strategies and lexical cues Chinese-speaking children utilized in early literacy learning on the level of the word/character. Differences among conditions and ages are presented.

The analysis proceeded according to four steps. In the first step, the correct responses children made on the tasks of Reading and Dictated Writing of Isolated Words were descriptively analyzed into three sets of possible lexical cues—the number of strokes, the number of components, and the spatial composition of components. In the next step, the erroneous responses on the tasks of Reading and Writing Isolated Words were examined in order to understand young children's systematic error patterns in early reading and writing. These systematic errors seem to be indicative of the strategies and mechanisms children use in constructing knowledge. From the regularities found in the erroneous responses, a set of internal qualities of characters was extracted for use in analyzing the erroneous responses. They were Stroke Contrast by Feature, Character Contrast by Strokes, and the Manner of Stroke Attachment (stated in Chapter Four).
In the third step, a set of patterns derived from the data was utilized to analyze the erroneous responses of Reading Isolated Words in order to understand the strategies children used in word recognition. The set of patterns found were Having Similarity with the Target Words, Utilizing Names in Recognition, Sound-graphics Correspondence without Distinguishing Features, and Sound-graphics Noncorrespondence without Distinguishing Features, which are described in detail below.

In the last step, a set of cues was derived from the data and utilized to analyze the erroneous responses on the error pattern of Having Similarity with the Target Words in order to understand the cues children implicitly utilized in word recognition reading. The set of cues was Having One Identical Component, Having Similarity with Components, Having Distinguishing Features, and Homonym.

The findings of the analysis of the data are presented in sequence following the logical steps stated above. The erroneous responses from the data of Dictated Writing of Isolated Words were presented in the previous section on Early Writing with other protocols in this Chapter.

The Number of Strokes

Correct Responses within Number of Stroke Categories by Condition

As reported on Table 21 and Figure 1, the influence of number of strokes on correct responses across three reading conditions and one writing condition reveals a fairly consistent pattern across responses in four conditions. In Condition 1 (Reading Words), an average of
56.0% of the 19 subjects had correct responses on characters having 3 to 5 strokes. An average of 25.7 had correct responses on characters having 6-7 strokes; 31.1 had correct responses on characters containing 8-9 strokes; and 47.2 had correct responses on characters having 10-13 strokes. In Conditions 2, 3, and 4 (Reading Pseudo-words, Reading Highlighted Words, and Dictated Writing), the respective percentages on characters of 3-5 strokes were 55%, 54.3%, and 41%. The data reveal that characters containing 3-5 strokes were most frequently among the correct responses across conditions (56%, 55%, 54.3%, and 41%); 10-13 strokes was the second (47.2%, 40.4%, 47.9%, and 23.3%); 8-9 strokes was the third (31.1%, 31.3%, 31.3%, and 8.3%); and characters of 6-7 strokes were the least frequently among the correct responses (25.7%, 19.7%, 27.2%, and 10%).
<table>
<thead>
<tr>
<th>Number of Strokes</th>
<th>Condition 1</th>
<th>Condition 2</th>
<th>Condition 3</th>
<th>Condition 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 - 5</td>
<td>56.0</td>
<td>55.0</td>
<td>54.3</td>
<td>41.0</td>
</tr>
<tr>
<td>6 - 7</td>
<td>25.7</td>
<td>19.7</td>
<td>27.2</td>
<td>10.0</td>
</tr>
<tr>
<td>8 - 9</td>
<td>31.1</td>
<td>31.3</td>
<td>31.3</td>
<td>8.3</td>
</tr>
<tr>
<td>10 - 13</td>
<td>47.2</td>
<td>40.4</td>
<td>47.9</td>
<td>23.3</td>
</tr>
</tbody>
</table>

* Condition 1: Reading Words  
* Condition 2: Reading Pseudo-words  
* Condition 3: Reading Highlighted Words  
* Condition 4: Dictated Writing Words
A PROFILE OF CORRECT RESPONSES WITHIN
NUMBER OF STROKE CATEGORIES BY CONDITION

FIGURE 1
Correct Responses within Number of Stroke Categories by Age  As reported on Table 22, across ages in Condition 1 (Reading Words) the highest rate of the use of the stroke number cues was 3-5 strokes (age three, 29.2%; age four, 50%; age five, 58.2%; and age six, 86.7%); the lowest was 6-7 strokes (8.3%, 0%, 27.7%, and 66.7%). As reported on Tables 23, 24, and 25, the stroke number pattern was the same. In addition to the stroke number cue, it was also found that there was a 20% increase between Ages three and four and a 30% increase between ages five and six in utilizing the Stroke Number Cues across conditions.
### TABLE 22
PERCENTAGE OF CORRECT RESPONSES WITHIN
NUMBER OF STROKE CATEGORIES BY AGE: CONDITION 1

<table>
<thead>
<tr>
<th>Number of Strokes</th>
<th>Age 3</th>
<th>Age 4</th>
<th>Age 5</th>
<th>Age 6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n= 4</td>
<td>n= 4</td>
<td>n= 6</td>
<td>n= 5</td>
</tr>
<tr>
<td>3 - 5</td>
<td>29.2</td>
<td>50.0</td>
<td>58.2</td>
<td>86.7</td>
</tr>
<tr>
<td>6 - 7</td>
<td>8.3</td>
<td>0.0</td>
<td>27.7</td>
<td>66.7</td>
</tr>
<tr>
<td>8 - 9</td>
<td>8.3</td>
<td>16.0</td>
<td>33.3</td>
<td>66.7</td>
</tr>
<tr>
<td>10 - 13</td>
<td>25.0</td>
<td>25.0</td>
<td>38.7</td>
<td>100.0</td>
</tr>
</tbody>
</table>

### TABLE 23
PERCENTAGE OF CORRECT RESPONSES WITHIN
NUMBER OF STROKE CATEGORIES BY AGE: CONDITION 2

<table>
<thead>
<tr>
<th>Number of Strokes</th>
<th>Age 3</th>
<th>Age 4</th>
<th>Age 5</th>
<th>Age 6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n= 4</td>
<td>n= 4</td>
<td>n= 6</td>
<td>n= 5</td>
</tr>
<tr>
<td>3 - 5</td>
<td>29.2</td>
<td>45.8</td>
<td>58.2</td>
<td>86.7</td>
</tr>
<tr>
<td>6 - 7</td>
<td>8.3</td>
<td>0.0</td>
<td>17.0</td>
<td>53.3</td>
</tr>
<tr>
<td>8 - 9</td>
<td>8.3</td>
<td>16.7</td>
<td>33.3</td>
<td>66.7</td>
</tr>
<tr>
<td>10 - 13</td>
<td>25.0</td>
<td>16.7</td>
<td>33.3</td>
<td>86.7</td>
</tr>
</tbody>
</table>
### TABLE 24

PERCENTAGE OF CORRECT RESPONSES WITHIN NUMBER OF STROKE CATEGORIES BY AGE: CONDITION 3

<table>
<thead>
<tr>
<th>Number of Strokes</th>
<th>Age 3 (n=4)</th>
<th>Age 4 (n=4)</th>
<th>Age 5 (n=6)</th>
<th>Age 6 (n=5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 - 5</td>
<td>29.2</td>
<td>45.8</td>
<td>55.3</td>
<td>86.7</td>
</tr>
<tr>
<td>6 - 7</td>
<td>8.3</td>
<td>16.7</td>
<td>17.0</td>
<td>66.7</td>
</tr>
<tr>
<td>8 - 9</td>
<td>8.3</td>
<td>16.7</td>
<td>33.3</td>
<td>66.7</td>
</tr>
<tr>
<td>10 - 13</td>
<td>16.7</td>
<td>25.0</td>
<td>49.7</td>
<td>100.0</td>
</tr>
</tbody>
</table>

### TABLE 25

PERCENTAGE OF CORRECT RESPONSES WITHIN NUMBER OF STROKE CATEGORIES BY AGE: CONDITION 4

<table>
<thead>
<tr>
<th>Number of Strokes</th>
<th>Age 3 (n=4)</th>
<th>Age 4 (n=4)</th>
<th>Age 5 (n=6)</th>
<th>Age 6 (n=5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 - 5</td>
<td>25.0</td>
<td>33.3</td>
<td>38.8</td>
<td>66.7</td>
</tr>
<tr>
<td>6 - 7</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>40.0</td>
</tr>
<tr>
<td>8 - 9</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>33.3</td>
</tr>
<tr>
<td>10 - 13</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>93.3</td>
</tr>
</tbody>
</table>
The Number of Components

Correct Responses within Number of Component Categories by Condition

As reported on Table 26 and Figure 2, correct responses within the number of component categories across the four conditions reveal a fairly consistent pattern. Overall, 58.5% of the correct responses in Condition 1 (Reading Words), 57.2% in Condition 2 (Reading Pseudo-words), 56.4% in Condition 3 (Reading Highlighted Words), and 40.4% in Condition 4 (Dictated Writing of Words) fell into the category of one component characters. Lower percentages of correct responses fell into the other component categories. Characters having four components were next likely to evoke correct responses (45.8%, 30.5%, 50%, and 25%); while characters having two components were the least likely (34.5%, 31.9%, 34.7%, and 16%).
TABLE 26
PERCENTAGE OF CORRECT RESPONSES WITHIN
NUMBER OF COMPONENT CATEGORIES BY CONDITION*

<table>
<thead>
<tr>
<th>Number of Components</th>
<th>Condition 1 (n=19)</th>
<th>Condition 2 (n=19)</th>
<th>Condition 3 (n=19)</th>
<th>Condition 4 (n=19)</th>
</tr>
</thead>
<tbody>
<tr>
<td>One</td>
<td>58.5</td>
<td>57.2</td>
<td>56.4</td>
<td>40.4</td>
</tr>
<tr>
<td>Two</td>
<td>34.5</td>
<td>31.9</td>
<td>34.7</td>
<td>16.0</td>
</tr>
<tr>
<td>Four</td>
<td>45.8</td>
<td>30.5</td>
<td>50.0</td>
<td>25.0</td>
</tr>
</tbody>
</table>

* Condition 1: Reading Words  
   Condition 2: Reading Pseudo-words  
   Condition 3: Reading Highlighted Words  
   Condition 4: Dictated Writing Words
A PROFILE OF CORRECT RESPONSES WITHIN
NUMBER OF COMPONENT CATEGORIES BY CONDITION

FIGURE 2
Correct Responses within Number of Component Categories by Age

As reported on Table 27, in Condition 1 (Reading Words), 30% of the three-year-olds, 60% of the four-year-olds, 59.8% of the five-year-olds, and 84% of the six-year-olds had correct responses on characters having one component. The percentage of correct responses on characters containing two components across ages were 13.9%, 11.1%, 35.1%, and 77.8%; respectively, on four component characters the percentages of correct responses by age were 25%, 25%, 33%, and 100%.

The data reveal that one-component characters were most frequent among the correct responses of the young children across ages. The least frequent category was Two Components. The same pattern was found in Conditions 2, 3, and 4 (see Tables 28, 29, and 30). It was also found that there were a 20% increase between ages three and four and a 30% increase between ages five and six in correctly utilizing the Component Number cues across conditions.
### TABLE 27

PERCENTAGE OF CORRECT RESPONSES WITHIN NUMBER OF COMPONENT CATEGORIES BY AGE: CONDITION 1

<table>
<thead>
<tr>
<th>Number of Components</th>
<th>Age 3 (n=4)</th>
<th>Age 4 (n=4)</th>
<th>Age 5 (n=6)</th>
<th>Age 6 (n=5)</th>
<th>( \bar{X} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>One</td>
<td>30.0</td>
<td>60.0</td>
<td>59.8</td>
<td>84.0</td>
<td>58.5</td>
</tr>
<tr>
<td>Two</td>
<td>13.9</td>
<td>11.1</td>
<td>35.1</td>
<td>77.8</td>
<td>34.5</td>
</tr>
<tr>
<td>Four</td>
<td>25.0</td>
<td>25.0</td>
<td>33.0</td>
<td>100.0</td>
<td>45.8</td>
</tr>
</tbody>
</table>

### TABLE 28

PERCENTAGE OF CORRECT RESPONSES WITHIN NUMBER OF COMPONENT CATEGORIES BY AGE: CONDITION 2

<table>
<thead>
<tr>
<th>Number of Components</th>
<th>Age 3 (n=6)</th>
<th>Age 4 (n=5)</th>
<th>Age 5 (n=6)</th>
<th>Age 6 (n=5)</th>
<th>( \bar{X} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>One</td>
<td>30.0</td>
<td>55.0</td>
<td>59.8</td>
<td>84.0</td>
<td>57.2</td>
</tr>
<tr>
<td>Two</td>
<td>13.9</td>
<td>11.1</td>
<td>31.6</td>
<td>71.1</td>
<td>31.9</td>
</tr>
<tr>
<td>Four</td>
<td>25.0</td>
<td>0.0</td>
<td>17.0</td>
<td>80.0</td>
<td>30.5</td>
</tr>
</tbody>
</table>
### TABLE 29

**PERCENTAGE OF CORRECT RESPONSES WITHIN NUMBER OF COMPONENT CATEGORIES BY AGE: CONDITION 3**

<table>
<thead>
<tr>
<th>Number of Components</th>
<th>Age 3 (n= 4)</th>
<th>Age 4 (n= 4)</th>
<th>Age 5 (n= 6)</th>
<th>Age 6 (n= 5)</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>One</td>
<td>30.0</td>
<td>55.0</td>
<td>56.4</td>
<td>84.0</td>
<td>56.4</td>
</tr>
<tr>
<td>Two</td>
<td>11.1</td>
<td>16.7</td>
<td>33.3</td>
<td>77.8</td>
<td>34.7</td>
</tr>
<tr>
<td>Four</td>
<td>25.0</td>
<td>25.0</td>
<td>50.0</td>
<td>100.0</td>
<td>50.0</td>
</tr>
</tbody>
</table>

### TABLE 30

**PERCENTAGE OF CORRECT RESPONSES WITHIN NUMBER OF COMPONENT CATEGORIES BY AGE: CONDITION 4**

<table>
<thead>
<tr>
<th>Number of Components</th>
<th>Age 3 (n= 4)</th>
<th>Age 4 (n= 4)</th>
<th>Age 5 (n= 6)</th>
<th>Age 6 (n= 5)</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>One</td>
<td>25.0</td>
<td>40.0</td>
<td>36.6</td>
<td>60.0</td>
<td>40.4</td>
</tr>
<tr>
<td>Two</td>
<td>2.8</td>
<td>0.0</td>
<td>5.6</td>
<td>55.6</td>
<td>16.0</td>
</tr>
<tr>
<td>Four</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>100.0</td>
<td>25.0</td>
</tr>
</tbody>
</table>
The Spatial Composition of Components

Correct Responses within Spatial Composition of Components

Categories by Condition As reported on Table 31 and Figure 3, the percent of correct responses within each spatial composition of components category reveals a fairly consistent pattern across conditions. A correct response rate of 35.6% was demonstrated in Condition 1 (Reading Words), 32.4% in Condition 2 (Reading Pseudo-words), 36.7% in Condition 3 (Reading Highlighted Words), and 14.2% in Condition 4 (Dictated Writing of Words) on components having Vertical Composition. Children used Vertical Composition of Components as a cue in reading and dictated writing on the word recognition level about 5% more frequently than they used Horizontal Composition of Components.
### TABLE 31

PERCENTAGE OF CORRECT RESPONSES WITHIN SPATIAL COMPOSITION OF COMPONENTS CATEGORIES BY CONDITION*

<table>
<thead>
<tr>
<th>Spatial Composition of Components</th>
<th>Condition 1</th>
<th>Condition 2</th>
<th>Condition 3</th>
<th>Condition 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertical</td>
<td>n = 19</td>
<td>35.6</td>
<td>32.4</td>
<td>36.7</td>
</tr>
<tr>
<td>Horizontal</td>
<td>n = 19</td>
<td>32.9</td>
<td>26.6</td>
<td>32.9</td>
</tr>
</tbody>
</table>

* Condition 1: Reading Words  
  Condition 2: Reading Pseudo-words  
  Condition 3: Reading Highlighted Words  
  Condition 4: Dictated Writing Words
A profile of correct responses within spatial composition of components categories by condition

Figure 3
Correct Responses within Spatial Composition of Component Categories by Age  As reported on Table 32, in Condition 1 (Reading Words) 16.7% of the three-year-olds, 12.5% of the four-year-olds, 33.2% of the five-year-olds, and 80% of the six-year-olds had correct responses within the Vertical Composition category, while 8.3% of the three-year-olds, 16.7% of the four-year-olds, 33.3% of the five-year-olds, and 73.3% of the six-year-olds had correct responses on Horizontal Composition category. It was also found that in Conditions 2, 3, and 4 (see Tables 33, 34, and 35) across ages Vertical Composition was used more frequently as a cue than Horizontal Composition (in Condition 2, 16.7%, 8.3%, 27.8%, and 76.7% opposed to 8.3%, 16.7%, 28%, and 53.3%; in Condition 3, 16.7%, 16.7%, 33.3%, and 80% opposed to 0%, 25%, 33.3%, and 73.3%; in Condition 4, 0%, 0%, 0%, and 56.7% opposed to 0%, 0%, 0%, and 53.3%). The data also reveal there were developmental differences of about 55% between ages five and six, and 15% between ages four and five, while no differences were found between ages three and four.
### Table 32
**Percentage of Correct Responses Within Spatial Composition of Components Categories by Age: Condition 1**

<table>
<thead>
<tr>
<th>Spatial Composition of Components</th>
<th>Correct Response Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Age 3</td>
</tr>
<tr>
<td>Vertical</td>
<td>n= 4</td>
</tr>
<tr>
<td></td>
<td>16.7</td>
</tr>
<tr>
<td>Horizontal</td>
<td>8.3</td>
</tr>
</tbody>
</table>

### Table 33
**Percentage of Correct Responses Within Spatial Composition of Components Categories by Age: Condition 2**

<table>
<thead>
<tr>
<th>Spatial Composition of Components</th>
<th>Correct Response Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Age 3</td>
</tr>
<tr>
<td>Vertical</td>
<td>n= 4</td>
</tr>
<tr>
<td></td>
<td>16.7</td>
</tr>
<tr>
<td>Horizontal</td>
<td>8.3</td>
</tr>
</tbody>
</table>
### TABLE 34
PERCENTAGE OF CORRECT RESPONSES WITHIN
SPATIAL COMPOSITION OF COMPONENTS CATEGORIES BY AGE: CONDITION 3

<table>
<thead>
<tr>
<th>Spatial Composition of Components</th>
<th>Age 3 (n=4)</th>
<th>Age 4 (n=4)</th>
<th>Age 5 (n=6)</th>
<th>Age 6 (n=5)</th>
<th>X</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertical</td>
<td>16.7</td>
<td>16.7</td>
<td>33.3</td>
<td>80.0</td>
<td>36.7</td>
</tr>
<tr>
<td>Horizontal</td>
<td>0.0</td>
<td>25.0</td>
<td>33.3</td>
<td>73.3</td>
<td>32.9</td>
</tr>
</tbody>
</table>

### TABLE 35
PERCENTAGE OF CORRECT RESPONSES WITHIN
SPATIAL COMPOSITION OF COMPONENTS CATEGORIES BY AGE: CONDITION 4

<table>
<thead>
<tr>
<th>Spatial Composition of Components</th>
<th>Age 3 (n=4)</th>
<th>Age 4 (n=4)</th>
<th>Age 5 (n=6)</th>
<th>Age 6 (n=5)</th>
<th>X</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertical</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>56.7</td>
<td>14.2</td>
</tr>
<tr>
<td>Horizontal</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>53.3</td>
<td>13.3</td>
</tr>
</tbody>
</table>
Erroneous Responses

Patterns of Erroneous Responses on Reading Isolated Words by Condition

As reported on Table 36, the frequency of erroneous responses (other than non-responses) in Condition 1 (Reading Words) was 15; in Condition 2 (Reading Pseudo-words), 46; in Condition 3 (Reading Highlighted Words), 34. The overall rate of erroneous responses without distinguishable features, that is Sound-Graphic Correspondence and Sound-Graphic Noncorrespondence, in Condition 1 (Reading Words) was 6.7% (6.7 + 0.0); in Condition 2 (Reading Pseudo-words), 23.9% (8.7 + 15.2); in Condition 3 (Reading Highlighted Words), 23.6% (11.8 + 11.8). Having Similarity was the highest erroneous responses pattern across the Reading Isolated Word condition (93.3%, 69.6%, and 73.5%); followed by Utilizing Names in Word Recognition (20%, 17.4% and 20.6%); Sound-Graphic Noncorrespondence (0%, 15.2%, and 11.8%); and Sound-Graphic Correspondence (6.7%, 8.7%, and 11.8%).
TABLE 36

FREQUENCY AND PERCENTAGE OF PATTERNS OF ERRONEOUS RESPONSES ON READING ISOLATED WORDS BY CONDITION*

<table>
<thead>
<tr>
<th>Patterns of Erroneous Responses</th>
<th>Condition 1</th>
<th>Condition 2</th>
<th>Condition 3</th>
<th>Subtotal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n= 15</td>
<td>n= 46</td>
<td>n= 34</td>
<td>n= 95</td>
</tr>
<tr>
<td></td>
<td>F %</td>
<td>F %</td>
<td>F %</td>
<td>F %</td>
</tr>
<tr>
<td>Having Similarity</td>
<td>14 93.3</td>
<td>32 69.6</td>
<td>25 73.5</td>
<td>71 74.7</td>
</tr>
<tr>
<td>Utilizing Names in Word Recognition</td>
<td>3 20.0</td>
<td>8 17.4</td>
<td>7 20.6</td>
<td>18 18.9</td>
</tr>
<tr>
<td>Sound-graphic Correspondence</td>
<td>1 6.7</td>
<td>4 8.7</td>
<td>4 11.8</td>
<td>9 9.5</td>
</tr>
<tr>
<td>Sound-graphic Noncorrespondence</td>
<td>0 0.0</td>
<td>7 15.2</td>
<td>4 11.8</td>
<td>11 11.6</td>
</tr>
<tr>
<td>Total**</td>
<td>18</td>
<td>51</td>
<td>40</td>
<td>909</td>
</tr>
</tbody>
</table>

* Condition 1: Reading Words
  Condition 2: Reading Pseudo-words
  Condition 3: Reading Highlighted Words
  Condition 4: Dictated Writing Words

** Note: Totals exceed n since multiple strategies were used on some protocols.
Patterns of Erroneous Responses on Reading Isolated Words by Age

As reported on Table 37, no erroneous responses were made by six-year-olds. This does not mean that the six-year-olds in this study had correct responses on every word, but that the six-year-old Chinese-speaking children in this sample did not take risks to guess unknown characters. They only responded when they felt they knew the correct answer.

As reported on Table 37, across ages three, four, and five the highest rate of the pattern of erroneous responses was within the category of Having Similarity (age three, 73.3%; age four, 69%; age five, 85.7%). The most common error pattern was Utilizing Names in Word Recognition. The percentage of erroneous responses in the Having Similarity category decreased from ages three to four (73.3% and 69%), while it increased at age five (85.7%). A similar finding was obtained within the pattern of Sound-graphic Correspondence (13.3%, 3.4%, and 9.5%). There were no erroneous responses in the category of Sound-graphic Noncorrespondence in ages five and six, while there was 24.1% in age four and 8.9% in age three. The erroneous responses without distinguishable features with target words were minimal: age three, 22.2% (13.3 + 8.9); age four, 27.5% (3.4 + 24.1); and age five, 9.5% (9.5 + 0.0). The frequency of erroneous responses by the four subjects at age three was 45; the frequency on the responses of the four subjects at age four was 29; and the frequency of erroneous responses by the six subjects at age five was 21.
### TABLE 37

**FREQUENCY AND PERCENTAGE OF PATTERNS OF ERRONEOUS RESPONSES ON READING ISOLATED WORDS BY AGE**

<table>
<thead>
<tr>
<th>Patterns of Erroneous Responses</th>
<th>Age 3</th>
<th>Age 4</th>
<th>Age 5</th>
<th>Age 6</th>
<th>Subtotal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n = 45*</td>
<td>n = 29</td>
<td>n = 21</td>
<td>n = 0</td>
<td>n = 95</td>
</tr>
<tr>
<td>F %</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Having Similarity</strong></td>
<td>33 73.3</td>
<td>20 69.0</td>
<td>18 85.7</td>
<td>0 0.0</td>
<td>71 74.7</td>
</tr>
<tr>
<td><strong>Utilizing Names in Word Recognition</strong></td>
<td>9 20.0</td>
<td>6 20.7</td>
<td>3 14.3</td>
<td>0 0.0</td>
<td>18 18.9</td>
</tr>
<tr>
<td><strong>Sound-graphic Correspondence</strong></td>
<td>6 13.3</td>
<td>1 3.4</td>
<td>2 9.5</td>
<td>0 0.0</td>
<td>9 9.5</td>
</tr>
<tr>
<td><strong>Sound-graphic Noncorrespondence</strong></td>
<td>4 8.9</td>
<td>7 24.1</td>
<td>0 0.0</td>
<td>0 0.0</td>
<td>11 11.6</td>
</tr>
<tr>
<td><strong>Total</strong>*</td>
<td>52</td>
<td>34</td>
<td>23</td>
<td>0</td>
<td>109</td>
</tr>
</tbody>
</table>

* Only erroneous responses in Conditions 1, 2, and 3 in Reading Isolated Words Task were coded for this table.

**Note:** Totals exceed n since multiple strategies were used on some protocols.
Patterns of Similarity of Erroneous Responses on Reading Isolated Words by Condition. The pattern of Having Similarity with the target words was further analyzed in order to understand the implicit systematic cues children used in word recognition across conditions. As reported on Table 38 and Figure 4, in Condition 1 (Reading Words) 50% of erroneous responses in the category of Similarity had One Identical Component with the target words; 35.7% had Similarity with Some Components; 14.3% had Distinguishing Features; and none were in the Homonym category. In Condition 2 (Reading Pseudo-words) erroneous responses in the categories of Having One Identical Component, Having Similarity with Some components, and Having Distinguishing Features had a very equal distribution (34.4%, 34.4%, and 31.2%). Once again, no responses showed the use of the Homonym pattern. In Condition 3 (Reading Highlighted Words) erroneous responses in Having Similarity with Some components and Having Distinguishing Features (40% and 36%) were higher than those in Having One Identical Component (24%), and the only 4% in the Homonym category.
<table>
<thead>
<tr>
<th>Category of Similarity</th>
<th>Condition 1</th>
<th>Condition 2</th>
<th>Condition 3</th>
<th>Subtotal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n= 14</td>
<td>n= 32</td>
<td>n= 25</td>
<td>n= 71</td>
</tr>
<tr>
<td></td>
<td>F %</td>
<td>F %</td>
<td>F %</td>
<td>F %</td>
</tr>
<tr>
<td>Having One Identical Component</td>
<td>7 50.0</td>
<td>11 34.4</td>
<td>6 24.0</td>
<td>24 33.3</td>
</tr>
<tr>
<td>Having Similarity with Some Components</td>
<td>5 35.7</td>
<td>11 34.4</td>
<td>10 40.0</td>
<td>26 36.1</td>
</tr>
<tr>
<td>Having Distiguishing Features</td>
<td>2 14.3</td>
<td>10 31.2</td>
<td>9 36.0</td>
<td>21 29.2</td>
</tr>
<tr>
<td>Homonym</td>
<td>0 0.0</td>
<td>0 0.0</td>
<td>1 4.0</td>
<td>1 1.4</td>
</tr>
<tr>
<td>Total**</td>
<td>14</td>
<td>32</td>
<td>26</td>
<td>72</td>
</tr>
</tbody>
</table>

* Condition 1: Reading Words  
Condition 2: Reading Pseudo-words  
Condition 3: Reading Highlighted Words  
Condition 4: Dictated Writing Words

** Note: Totals exceed n since multiple strategies were used on some protocols.
A PROFILE OF THE PATTERNS OF SIMILARITY
OF ERRONEOUS RESPONSES BY CONDITION

FIGURE 4
Patterns of Similarity of Erroneous Responses by Age

As reported on Table 39 and Figure 5 the frequency of erroneous responses in Similarity was 33 in age three, 20 in age four, 18 in age five, and 0 in age six. The percentage of erroneous responses in the Having Distinguishing Features with the target words category for age three was 48.5%; for age four, 10.0%; for age five, 16.7%; and for age six, 0%. At age three, the order of erroneous response frequency in the pattern of Similarity was Having Distinguishing Features (48.5%), then Having Similarity with Some Components (27.3%), then Having One Identical Component (24.2%) and Homonym (3%). At age four, the order was Having One Identical Component (55%), Having Similarity with Some Components (35%), Having Distinguishing Features (10%), and Homonym (0%). At age five, the order was Having Similarity with Some Components (55.6%), Having One Identical Component (27.8%), Having Distinguishing Features (16.7%), and Homonym (0%).
TABLE 39
FREQUENCY AND PERCENTAGE OF PATTERNS OF SIMILARITY OF ERRONEOUS RESPONSES ON READING ISOLATED WORDS BY AGE

<table>
<thead>
<tr>
<th>Visual Cue Category</th>
<th>Age 3</th>
<th>Age 4</th>
<th>Age 5</th>
<th>Age 6</th>
<th>Subtotal</th>
</tr>
</thead>
<tbody>
<tr>
<td>n= 33*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F %</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Having One Identical Component
8 23.5 11 55.0 5 27.8 0 0.0 24 33.3

Having Similarity with Some Components
9 26.5 7 35.0 10 55.6 0 0.0 26 36.1

Having Distinguishing features
16 47.1 2 10.0 3 16.7 0 0.0 21 29.2

Homonym
1** 2.9 0 0.0 0 0.0 0 0.0 1 1.4

Total***
34 100.0 20 100.0 18 100.0 0 0.0 72 100.0

* Data from erroneous responses within the category of Having Similarity in Conditions 1, 2, and 3 in Reading Isolated Words Task were coded for this table.

** The error in the Homonym category coded twice: once in the category of Having One Identical Component and secondly in the Homonym category, since the target "妈妈", ma, 'Mom' is a signifier-phonograph, "馬", ma, 'horse' is the phonogram of "馬", ma but it is also a mono-character of "馬", ma.

*** Note: Totals exceed n since multiple strategies were used on some protocols.
A PROFILE OF THE PATTERNS OF SIMILARITY OF ERRONEOUS RESPONSES BY AGE

FIGURE 5
Reading a Story Book

The transcribed data on the task of Reading a Story Book were descriptively and sequentially analyzed in terms of Reading Styles, Reading the Title Page, and Conventional Reading Style. Differences by ages are presented in order to provide a comprehensive view.

Reading Styles

When the researcher handed the story book, 我的一天, wǒ de 1 tian, 'My One Day' to the child backward and upside down and asked the child to read, seven of the 19 children read from the back page. They pretended to read or read the book by making up a story to fit the pictures, moving from the back of the book to the front. An additional seven of the 19 also pretended to read by making up a story to fit the pictures, but moved from the front of the book to the back page. The remaining five read the book word by word, column by column, and page by page in conventional reading style.

Reading Styles by Age. As reported on Table 40, 50% of the three-year-olds, 75% of the four-year-olds, 16.67% of the five-year-olds, and 20% of the six-year-olds read the story book from the back page of the book to the front. Eighty percent of the six-year-olds and 16.67% of the five-year-olds read the story book in conventional adult fashion, while none of three- and four-year-olds did. A total of 66.67% of the five-year-olds, 25% of the four-year-olds, and 50% of the three-year-olds utilized the picture cues in the book to pretend to read.
### TABLE 40

**FREQUENCY AND PERCENTAGE OF READING STYLES BY AGE**

<table>
<thead>
<tr>
<th>Reading Styles</th>
<th>Age 3</th>
<th>Age 4</th>
<th>Age 5</th>
<th>Age 6</th>
<th>Subtotal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n= 4</td>
<td>n= 4</td>
<td>n= 6</td>
<td>n= 5</td>
<td>n= 19</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>%</td>
<td>F</td>
<td>%</td>
<td>F</td>
</tr>
</tbody>
</table>

| Conventional Reading   | 0     | 0.00  | 0     | 0.00  | 1       | 16.67   | 4     | 80.00 | 5     | 26.32   |
| Reading by Picture Cues| 2     | 50.00 | 1     | 25.00 | 4       | 66.67   | 0     | 0.00  | 7     | 36.84   |
| Reading from Back Page | 2     | 50.00 | 3     | 75.00 | 1       | 16.67   | 1     | 20.00 | 7     | 36.84   |
Reading the Title Page

The categories of Conventional Reading and Reading by Picture Cues in Reading Styles revealed children's knowledge of handling and reading a book from the front page to the back. The researcher further attempted to determine the children's knowledge of book titles. The data from the categories of Conventional Reading and Reading by Picture Cues were further analyzed to understand children's behavior on reading the title page by ages.

Reading the Title Page by Age As reported on Table 41, three out of the twelve children who knew how to handle a book read the title page, while the remaining nine did not. The percentage of Reading the Title Page by Ages gradually increased from ages four to six (age three, 0%; age four, 0%; age five, 20%; and age six, 50%). In four of the six-year-old subjects, half read the title page and half did not. Interestingly, none of the 19 subjects cared about and/or read the author's name.
**TABLE 41**

**FREQUENCY AND PERCENTAGE OF READING THE TITLE PAGE BY AGE**

<table>
<thead>
<tr>
<th>Reading The Title Page</th>
<th>Age 3</th>
<th>Age 4</th>
<th>Age 5</th>
<th>Age 6</th>
<th>Subtotal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n= 2*</td>
<td>n= 1</td>
<td>n= 5</td>
<td>n= 4</td>
<td>n= 12</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td>Yes</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0.0</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>100.0</td>
<td>1</td>
<td>100.0</td>
<td>4</td>
</tr>
<tr>
<td>No</td>
<td>1</td>
<td>50.0</td>
<td>2</td>
<td>50.0</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>50.0</td>
<td>2</td>
<td>50.0</td>
<td>9</td>
</tr>
</tbody>
</table>

* Only subjects from the categories of Conventional Reading and Reading by Pictures Cues in Reading Styles were used for this table.
Conventional Reading Style

Five out of 19 subjects read the story book in conventional adult fashion. Four of these were six years old and one was five years old. Two six-year-olds read the story without any error. The other three, two six-year-olds and one five-year-old, made use of predicting, confirming, and intergrating strategies in reading.

The purpose of this part of the analyses was to examine the grapho-phonic, syntactic, and semantic cues subjects used while reading and to observe the patterns of miscues they made and the particular strategies they used. Data from the three subjects, one five-year-old and two six-year-olds, were analyzed into patterns of miscues. However, due to the low percentage (less than 1%) of miscues, analyses in relation to the following aspects: (1) reading strategies—correction, grammatical acceptability, semantic acceptability, and meaning change; (2) sound/graphic relationships; (3) grammatical relationships; and (4) comprehension patterns were not warranted. Data and interpretation for patterns of miscues are presented below.

Patterns of Miscues by Three Chinese-speaking Children  As reported on Table 42, the data reveal that omission was the most frequent miscue pattern the three Chinese-speaking children made. Substitution was the second, then correction. The miscue patterns of substitution and omission were made by two subjects and correction was made by one subject. The following miscue patterns were not made by the three children in this study: insertion, reversal, abandoning a
correct form, unsuccessfully attempting to correct, and anticipating difficulty with a subsequent word. The data reveal that omission and substitution were common miscue patterns made by Chinese-speaking children in this study.
### TABLE 42
FREQUENCY OF FIVE PATTERNS OF MISCUES IN READING
A STORY BOOK BY THREE CHINESE-SPEAKING CHILDREN

<table>
<thead>
<tr>
<th>Patterns of Miscues</th>
<th>A Five-year-old Boy</th>
<th>A Six-year-old Boy</th>
<th>A Six-year-old Boy</th>
<th>Average Per Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>Frequency</td>
<td>Frequency</td>
<td></td>
</tr>
<tr>
<td>Substitutions</td>
<td>1</td>
<td>3</td>
<td>0</td>
<td>1.3</td>
</tr>
<tr>
<td>Omissions</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>1.7</td>
</tr>
<tr>
<td>Insertions</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Reversals</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Repetition</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0.7</td>
</tr>
<tr>
<td>a. Correcting A Miscue</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0.7</td>
</tr>
<tr>
<td>b. Abandoning A Correct Form</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>c. Unsuccessfully Attempting To Correct</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>d. Anticipating Difficulty With A Subsequent Word</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Total of Miscues</td>
<td>1</td>
<td>5</td>
<td>5</td>
<td>3.7</td>
</tr>
</tbody>
</table>
TABLE 43

FREQUENCY OF MISCUES AND PERCENTAGE OF MISCUES PER WORD
IN READING A STORY BOOK BY THREE CHINESE-SPEAKING CHILDREN

<table>
<thead>
<tr>
<th>Subject</th>
<th>Frequency of Miscues</th>
<th>Percentage of Miscues Per Word</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Five-year-old Boy</td>
<td>1</td>
<td>0.020</td>
</tr>
<tr>
<td>A Six-year-old Boy</td>
<td>5</td>
<td>0.098</td>
</tr>
<tr>
<td>A Six-year-old Boy</td>
<td>5</td>
<td>0.098</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>11</strong></td>
<td><strong>0.072</strong></td>
</tr>
</tbody>
</table>

Total Words = 51
Summary

The four tasks—Uninterrupted Writing, Dictated Writing of Isolated Words/Characters, Reading Isolated Words/Characters, and Reading a Story Book—were examined as to three finding categories—early writing, reading and writing of isolated words, and reading a story book.

Frequencies, percentages, and means were calculated in each category by age and condition. Comparison were drawn among tasks, modes, and ages in each category.

In the category of early writing, the tasks of Uninterrupted Writing and Dictated Writing of Isolated Words were examined as to the Mean Number of Characters, Components Parts and Strokes per Character, Writing/Spelling Strategies, and Developmental Patterns of Early Writing in Lexicon in order to understand the strategies, miscue patterns and orthographic cues Chinese-speaking children utilized in early writing.

In the category of reading and writing of isolated words, the tasks of Reading and Dictated Writing of Isolated Words were examined as to two subcategories—Correct Response within the Orthographic Cue Categories and Patterns of Erroneous Responses. The subcategory of Correct Responses within the Orthographic Cues was analyzed into three orthographic cue categories—Number of Stroke, Number of Component, and the Spatial Composition of Components. The other subcategory of patterns of erroneous responses was examined as to Having Similarity with the Target Words, Utilizing Names in Word Recognition,
Sound-graphic Correspondence, and Sound-graphic Noncorrespondence. The miscue pattern of Having Similarity with the Target Words was further analyzed into four sub-erroneous patterns—Having One Identical Component, Having Similarity with Some Components, Having Distinguishing Features, and Homonym.

In the category of reading a story book, the task of Reading a Story Book was examined as to Reading Styles, Reading the Title Page, and Conventional Reading Style. The Conventional Reading Style was further analyzed into Patterns of Miscues.

Findings plus a discussion drawn from the data, and recommendations for future research are presented in Chapter six.
CHAPTER SIX
FINDINGS, DISCUSSION AND RECOMMENDATIONS

The main purpose of this study was to investigate the early literacy learning process of Chinese-speaking children in terms of the patterns and strategies of early writing/spelling and reading, including their use of Chinese orthographic cues.

The innate-constructivist paradigm of language learning has been generally applied to language and literacy learning of those languages with alphabetic writing systems, e.g., English and Spanish, while comparatively very little is known about how different writing systems, particularly logographic systems like Chinese, affect the learning process. It was generally thought that because of the different characteristics of Chinese and English in spoken and written language (phonology, morphology, orthography, syntax, and semantics), the learning strategies of beginning learners may be different (Downing and Leong, 1982; Gibson and Levin, 1975; Martin, 1972). Beginning readers in different writing systems may face different learning tasks when they learn how to read and to write printed symbols constructed on different principles (Hung and Tzeng, 1981; Tzeng and Hung, 1980).

Up to now, there has not been any research based on this innate-constructivist paradigm looking at how Chinese-speaking
children learn linguistic tasks in the process of early literacy, what linguistic features in the Chinese logographic system serve as the cues for the Chinese beginning learners, what systematic constructive patterns exist in early literacy learning in Chinese, or what differences there are in constructive patterns in learning Chinese and English. Thus, this research sought to gain some insight into the nature and characteristics of this early written language development by examining such dimensions as: (1) the orthographic cue systems used in early literacy access, (2) the strategies utilized in graphic-sound-meaning association, and (3) the miscue patterns in early writing/spelling and reading.

The findings about the early literacy learning process of Chinese-speaking children in this study would assist in furthering our understanding of how children of different languages and cultures adjust to meet various task demands imposed by different orthographies when learning to read and write. The discussion will be organized around the three primary research questions.

What available orthographic cue systems inherent in the Chinese writing system are utilized by Chinese-speaking children in word recognition? What developmental differences, if any, exist?

The possible lexical cue systems inherent in Chinese orthography initially identified on the character/word level were the number of strokes, the number of components, and the spatial composition of components.
In addition, through the conceptual analytic method, a set of internal qualities of characters was elicited from the erroneous responses in children's reading and writing/spelling protocols. The internal qualities of characters represent other identifiable lexical cues systematically utilized by Chinese-speaking young children to recognize and/or construct characters. The qualities identified were as stroke contrast by feature, character contrast by strokes, and the manner of stroke attachment.

One of the most general findings in this study was that across all age levels, Chinese-speaking children utilized the inherent Chinese orthographic cues in word recognition. However, besides the three sets of orthographic cues, there are some other possible cues that are also used. In this study it was found that familiarity of words might be a very important possible cue for children in word recognition. In addition, children across ages tacitly employed a set of lexical cues on the internal qualities of characters to invent characters in writing/spelling and to guess characters in word recognition. These are discussed in greater detail in each finding of the Three Sets of Chinese Orthographic Cues by Age.

The Three Sets of Chinese Orthographic Cues by Age

The Number of Strokes

The number of the script strokes in Chinese can vary from one to thirty. The studies of Chuang (1938) and Leong (1970) reported 11.27 as the mean stroke number of characters and 4.45 as the standard deviation. The strokes do not represent the phonetic and semantic
entities as do English letters or letter clusters, but the number of strokes might provide a visual clue for beginning learners to estimate simplicity or complexity of a character configuration.

The data of 38 writing protocols reveal that the mean stroke number of characters written correctly by children across ages and writing modes was 4.54 in this study, quite a bit lower than the 11.27 mean in Leong's study by adult writers. In examining the data from the tasks of Reading Isolated Words and Dictated Writing in this study, it was found that the highest correct response rates were in the category of characters having 3-5 strokes. The next highest correct response rates were in the category of characters having 10-13 strokes, followed by 8-9 strokes, and 6-7 strokes. The data suggest the Number of Strokes are a cue but not a notably independent one utilized by children in word recognition and dictated writing. For instance, although all of the target words were common in Chinese daily use, the words in the category of 10-13 Strokes, i.e., 高, qīng, 'high'; 家, jiā, 'home'; and 媽, mā, 'Mom', particularly 媽, mā, 'Mom' are high familiarity words for young children, while the words in the category of 6-7 Strokes, i.e., 我, wǒ, 'I'; 年, nián, 'year'; and 床, chuáng, 'bed' are comparatively less familiar for them. This might suggest that familiarity may be a possible concurrent cue in word recognition.

The Number of Components

Over 90% of Chinese characters are of compound forms composed by two or more component parts vertically, horizontally or in an enclosed
manner. One part, usually the right part, covertly reflects sound, while the other part reflects meaning or the category of semantics. The component parts not only approximately indicate the phonetic and semantic entities, but the number of component parts provides a visual clue for early learners to estimate the simplicity or complexity of a character configuration and spatial composition of a character.

The data from the 38 writing protocols obtained during this study reveal that children across ages and writing modes wrote characters composed of more than one part. The total average of the number of the components of characters was 1.44, with a range of less than 1. The data from the Reading Isolated Words and Dictated Writing tasks reveal that the Number of Components was a cue but not an independent one utilized by children across ages and reading conditions in word recognition. For instance, the word containing four components, i.e., 高, 'high' had a higher correct response rate (by about 10%) than words containing two components, i.e., 爸, 'Dad'; 媽, 'Mom'; 我, 'I'; 星, 'star'; 年, 'year'; 洗, 'wash'; 天, 'sky'; 家, 'home'; and 床, 'bed'. The data from the Reading Isolated Words and Dictated Writing tasks suggested that the words with only one component, i.e., 大, 'big'; 中, 'middle'; 手, 'hand'; 牙, 'teeth'; and 小, 'little', were recognized more easily than those with two or four components. It might be interpreted that a character with a single unit, i.e., character with one component is recognized more easily than those with multiple units.
The Spatial Composition of Components

The compound form character contains components in vertical $\text{□}$, horizontal $\text{□}$, or enclosure $\text{□}$, $\text{□}$ spatial positions. Position provides a visual cue for estimating the character configuration.

The data from the tasks of Dictated Writing and Reading Isolated Words suggest that across ages and conditions, the children used the Vertical Composition of Components, i.e., 爸, bà, 'Dad'; 高, gāo, 'high'; 星, xīng, 'star'; 年, nián, 'year'; 床, chuān, 'bed'; and 家, jiā, 'home', as a cue more frequently than the Horizontal Composition of Components, i.e., 媽, mā, 'Mom'; 我, wǒ, 'I'; and 洗, xǐ, 'wash'. Due to the small size of the sample in this study, it cannot be concluded that the cue of Vertical Composition of Components is more obvious than the cue of Horizontal Composition of Components, but in general, it can be said that the spatial composition of components is a cue that is used actively by children in recognizing and composing characters across ages.

With regard to the use of orthographic cues by age, it was found that there was a gradual developmental change across the three- to six-year-old span, particularly between the ages of three and four, as well as between the ages of five and six, in utilizing the cues of the stroke number and the component number. On the cue of spatial composition of components, there was a notable (55%) developmental difference between the ages of five and six and a 15% difference between the ages of four and five across conditions, while no difference was found between the ages of three and four. In general,
the data suggest that five- and six-year-old Chinese children in this study were more aware of the orthographic cues than three- and four-year olds.

The Internal Qualities of Characters—Another Lexical Cue

One of the main findings in this study was that across all ages, Chinese young children do employ a set of identifiable abstract visual rules to construct characters in writing/spelling and to test characters in word recognition. The set of visual rules—the internal qualities of characters—were elicited from the erroneous responses of children's writing and reading protocols. They are the feature of strokes (stroke contrast by feature), the presence/absence of the first stroke (character contrast by strokes), and the manner of stroke attachment.

The rule of stroke contrast by feature describes how strokes contrast minimally by the presence or absence of distinguishing features, e.g., —, horizontal straight; —, horizontal straight with right hook; —, right curve with up hook; and —, right oblique with hook. It was found that in children's writing/spelling in this study —, vertical straight with left hook, is a commonly used feature. For example, a three-year-old boy invented — for 手, shou, 'hand'; a four-year-old boy invented —; and another five-year-old boy wrote —. Similarly, —, right curve with up hook, is a commonly used feature in word recognition. For instance, children read —, —, 'a last name'; 先, xian, 'before'; 風, fenq, 'wind'; and 克, ke, 'overcome' for the target word—洗 Xi.
The rule of character contrast by strokes describes how characters contrast minimally by the presence and/or absence of strokes, e.g., 太, 大, 'big' contrasts with 太, 太, 'much' in having an extra dot in the bottom inside, with 大, 大, 'dog' in having an extra dot in the upper right corner. In this study it was found that the rule of character contrast by strokes are utilized often by young children. For instance, in writing/spelling, 木, 木, 'wood'; and 人, 人, 'person' were written for 大, 大, 'big'; in word recognition, 人, 人 was confused with the target word--大, 大, 'big'. In writing/spelling, a five-year-old boy wrote 我 for 我, 我, 'I'; a five-year-old girl invented it as 我; and a six-year-old boy wrote 木 for 木, 木, 'I'. In word recognition, 我, 我, 'I' was recognized as 我, 我, 'search'; 徐, 徐, 'a last name'; 手, 手, 'hand'; and 友, 友, 'friend'. The invented character 年 was written by a six-year-old girl for 年, 年, 'year', which was written as 年 by a five-year-old boy, and 十, 十, 'noon' by a three-year-old boy. In word recognition, 年, 年, 'year' was recognized as 十, 十, 'noon'; 牛, 牛, 'cow'; 五, 五, 'five'; and 科, 科, 'a section'.

The rule of the manner of stroke attachment describes how characters contrast by the manner of stroke attachment, e.g., 天, 天, 'sky' differs from 天, 天, 'man' in the manner of stroke attachment of the first stroke; 午, 午, 'noon' contrasts with 牛, 牛, 'cow' in the manner of stroke attachment of the horizontal
straight stroke. In this study it was found that the manner of stroke attachment is the most frequent rule utilized by children in writing/spelling and word recognition. For instance, in writing/spelling, 爸, bà, 'Dad' was written as 爸 by two children, one six-year-old girl and one five-year-old boy; and 爸 by a four-year-old boy. In word recognition, 爸, bà, 'Dad' was recognized as 色, sè, 'color' by a four-year-old girl based on the similarity of the bottom part—巴, bà, 'to expect', and the contrast of stroke attachment of the upper part, that is, 父, fù, 'father' contrasted with 爸. For 媽, má, 'Mom', in writing/spelling, 黃 and 黒 were invented; in word recognition, 媽, má, 'Mom' was recognized as 娛, fèng, 'phoenix'; 鴨, jiā, 'duck'; and 馬, mà, 'horse'. 鳳, fèng and 鴨, jiā have a similar part with 鳥, niǎo, 'bird', which is visually close to the part of 馬, mà, 'horse' in the character of 媽, má, 'Mom'. For 高, gāo, 'high', 高, and 午 were written, which contained the manner of enclosure in vertical direction. In word recognition, 高, gāo, 'high' was recognized as 國, guó, 'country' and 南, nán, 'south' which also contained the manner of enclosure with the distinguishing strokes of 门 (高, 國, 南). For 家, jiā, 'home', 夫 and 妻 were invented by three- and five-year-olds. In word recognition, most of the three- and four-year-olds confused 家, jiā, 'home' with 象, xiàng, 'elephant'. In invented writing, the youngers condensed 家, jiā, 'home' into 夫 and 妻 based on the rules of the manner of stroke attachment and stroke contrast by
feature. 象, xiàon, 'elephant', and 家, zìa, 'home' both have the same part of 家 at the bottom but differ on the top part by the stroke feature and attachment.

From the children’s writing protocols and erroneous responses in word recognition, it was found that Chinese-speaking young children tacitly recognize certain visual contrasts and similarities in that they demonstrate these in their original unique writing/spelling and oral response. They tacitly compare, contrast, and set discernible and logical decodable rules to construct convention-like characters without any formal instruction. The findings in this study suggest that at least some Chinese-speaking children, before they learn standard writing/spelling, tacitly construct a set of systematic abstract visual rules, i.e., the number of strokes of a character, the number of components of a character, the spatial composition of components of a character, stroke contrast by feature, character contrast by strokes, and the manner of stroke attachment, to invent and to recognize characters. The set of identifiable rules in graphic figures constructed by Chinese-speaking children is different from the rules in graphic-sound relations by English-speaking children.

In English, where the orthography is morphophonemically based, young children begin by pairing spellings with segments abstractly categorized in terms of a hierarchy of articulatory features, while in Chinese, a morphemic and iconic orthography, children pair writings/spellings with segments abstractly categorized in terms of a global visual features. The reason for the difference on the
constructive rules might be the different characteristics of Chinese and English in spoken and written modes, particularly in orthography, but it needs to be further studied.

What miscue patterns are made by Chinese-speaking children in early writing/spelling and reading? What developmental differences, if any, exist?

Examination of early writing and reading data from the three tasks--Uninterrupted Writing, Dictated Writing, and Reading Isolated Words, reveals that across ages, young children implicitly construct and utilize the internal qualities of characters to write and to recognize characters. In the literacy process, they develop their own systems and structures that are not conventional but are logical and identifiable. These preliminary constructive systems are revealed in the miscue patterns in their writing and reading stated below.

Miscue Patterns in Writing/Spelling by Age

The examination of writing protocols reveals that young children’s constructive systems in writing show a developmental pattern. The pattern progresses from global to more differentiated features of print. The order of developmental patterns found in early writing in this study is from scribbling to using the last name for every word, iconic pictographic writing, pictographic invented writing, invented writing with mild distinguishable quality, invented writing with distinguishable quality, writing with few absent/added strokes, writing by homonym character, writing by phonemic symbols, and finally correct writing.
In this study 40.43% of the writing protocols (38 out of 94) fell into the high level of non-invented writing, i.e., writing by homonym character, writing by phonemic symbols and correct writing, while 55.32% (52 out of 94) fell into the level of invented writing, i.e., iconic pictographic writing, pictographic invented writing, invented writing with mildly distinguishable qualities, invented writing with distinguishable qualities, and writing with few absent/added strokes. Only one three-year-old girl (2.13%) consistently wrote her last name for every word across writing conditions, and one three-year-old boy (2.13%) also consistently scribbled across conditions.

In the invented patterns of early writing in this study, 13.2% of the writing protocols drew iconic pictures of words to represent their meaning. For instance, 星 was drawn for 星, xīng, 'star'; 手 for 手, shǒu, 'hand'; 家 for 家, jiā, 'home'; 牙 for 牙, yá, 'teeth'; and 床 for 床, chuáng, 'bed'. In addition, 23.7% of the writing protocols utilized the internal qualities of characters and some of the lexical cues—the number of components and the spatial composition of components to combine strokes and/or stroke-like elements in a square frame to invent pictographic-like characters. For instance, 洗 for 洗, xǐ, 'wash'; 我 for 我, wǒ, 'I'; and 媽 for 媽, má, 'Mom'. In 7.9% of the writing protocols the children also utilized the internal qualities of characters and the lexical cues to invent recognizable characters that were not highly distinguishable. For instance, 水 was invented for 水, shuǐ, 'hand'; 牙 for 牙, yá, 'teeth'; 云 and 木 for 家, zì,
'home'; and 童 for 床, chuang, 'bed'. In 57.9% of the writing protocols the children utilized the cues to invent identifiable characters in forms of mirror writing, upside down writing, and/or writing distinguishable features. For instance, 難 for 媽, ma, 'Mom'; 爸 for 爸, ba, 'Dad'; 小 for 小, xiao, 'little'; 大 for 大, da, 'big'; 洗 for 洗, xi, 'wash'; 龍 for 龍, long, 'dragon'; 高 for 高, gao, 'high'; and 星 for 星, xing, 'star'. In 34.2% of the writing protocols the children wrote characters with few absent/added strokes or wrong strokes. For instance, 我 for 我, wo, 'I'; 媽 for 媽, ma, 'Mom'; 年 for 年, nian, 'year'; and 爸 for 爸, ba, 'Dad'.

From the data of the invented patterns of early writing in this study, it was found that across the ages of three, four, five, and six, Chinese-speaking children did utilize the cues concerning the internal qualities of characters and the lexical visual cues, particularly the component number and the spatial composition of components, to take risks in inventing characters which were approximately close to conventional writing or recognizably close to pictographic-like writing. Furthermore, it was found that only 11.5% of writing protocols (3 out of 26) in the invented patterns by the ages of five and six fell into the low level of invented writing, i.e., iconic pictographic writing and pictographic invented writing, while the rest (88.55%) were in the high level, i.e., invented writing with distinguishable qualities and writing with few absent/added strokes. However, the opposite phenomenon was found at the ages of
three and four. A total of 55.6% of the writing protocols in the invented patterns by children of ages of three and four were in the lower level, while 44.4% were in the higher level. The data might suggest that the more experience in written language children encounter, the more they develop orthographic awareness of characters. Moreover, the data also suggest that in general Chinese young children in this study were much more aware of the features of characters than was previously thought. Most of them often utilized the rules of the internal qualities of characters to construct characters.

The findings in this study support Van Zian's (1962) findings that character learning was dominated by the visual aspects of characters. In Zian's study, the first grade Chinese-speaking children first related previously learned sound/meaning association with only the global shape of written characters. Then they associated sound/meaning with component parts of characters and often wrongly substituted parts from similarly shaped characters. Finally, they were able to make the correct associations between sound/meaning and the correct strokes of characters. His study indicated that the character learning progressed from writing a global configuration of a character to substituting component parts of a character, and finally to writing correct strokes of a character. In other words, the character learning by Chinese six-year-olds in Zian's study (1962) moved from visually global features of characters to more differentiated features of characters. The same character learning progress, i.e., from gross processing to fine discrimination, and
characteristics, i.e., using visual features of characters, was also found in this study.

In the non-invented patterns of early writing in this study, 7.9% of the writing protocols (66.7% from age six, 33.3% from age five, and none from ages four and three) were by homonym characters. For instance, 忠, zhōng, 'loyalty' was written for 中, zhōng, 'middle'; and 馬, mā, 'horse' for 媽, mā, 'Mom'. Homonyms in Chinese differ in meaning but share the same pronunciation and some parts of the graph. For instance, 忠 with 中, shares the same sound zhōng, even the same tone (the first tone) and the same part of the graph, 中. In 13.2% of writing protocols (100% from age six, and none from ages five, four, and three) the children wrote by phonemic symbols, i.e., 々, 々, 々, and 々, etc., for instance, 矢 for 星, xīng, 'star'; 床 for 床, chuáng, 'bed'; and 洗 for 洗, xǐ, 'wash'. The data suggest that the more experience in written language children encounter, the more their phonological awareness in homonyms emerges. They also reveal that after a semester of formal schooling instruction the first graders utilized the strategy of writing by phonemic symbols to spell characters which they could say but did not know how to write the characters. The phonemic symbols functioned as a phonetic aid to help the Chinese young children to code the spoken language into the written form. In Taiwan, during the first ten weeks of the first school year, all of the first graders receive intensive instruction on the sound and graph of phonemic symbols and the composition of phonemic symbols and tones. Evidently,
the data in this study support the notion that formal schooling instruction affects children's literacy learning (Clay, 1984; Deford, 1985; Ferreiro, 1982; Harste, Burke, and Woodward, 1981, 1983) at least in this relatively limited sense as the phonemic symbols are merely a "way station" to reading actual characters.

Finally, the data from the early writing protocols also reveal that children's writing does not progress "perfectly" through linear sequential levels. Overlap occurs between levels, and apparent regressions to lower levels of patterns are frequent in early writing. For instance, a five-year-old girl wrote 迈 for 洗, xǐ, 'wash' which belonged to the level of invented writing with distinguishable qualities, and 我 for 我, wǒ, 'I' which belonged to the level of pictographic invented writing. However, in general, children consistently progress through developmental stages. For instance, most of the miscue patterns by four-year-olds fell into the low level of invented writing and none in the level of non-invented writing, while all the miscue patterns by six-year-olds fell into the high level of invented writing and the level of non-invented writing. The findings from this study support the notion (Clay, 1975; DeFord, 1980) that development in early writing does not progress in an exclusively linear sequence but rather with limited regression.

In the English alphabetic writing system, the development of early invented writing goes through scribbling; to differentiation between drawing and writing; to concepts of linearity, uniformity, inner complexity, symmetry; to development of letters and letter-like
shapes; to combination of letters which may or may not show letter-sound correspondence; then to development of sound-letter correspondence with use of invented spellings (these developmental stages have been fully stated in Chapter Two). This suggests that early writing in the English alphabetic writing system is first dominated by visual features of script, i.e., word, as in the first four stages, then by letter-sound features as in the later three stages. The data in this study revealed that early writing in the Chinese logographic writing system is also first dominated by visual features of script, i.e., character, as in the first seven stages, then by phonetic features of characters, as in the last few stages of writing by homonym characters and writing by phonemic symbols.

Comparing and contrasting the developmental patterns of early invented writing in the English alphabetic and Chinese logographic writing systems reveal that the early writing across writing systems is first dominated by visual features of script, but which differ in characteristics due to the difference of orthography. Then awareness and development of the phonetic features of script occur, as with letter-sound graphophonemic correspondence in English and homonym characters in Chinese.

**Miscue Patterns in Reading by Age**

Upon examination of patterns of erroneous responses on the three conditions of Reading Isolated Words/Characters—Reading Normal Words, Reading Pseudo-words, and Reading Highlighted Words—it was found that across the ages of three, four, and five (with the exception of age
six) and across conditions, it was clear that the four miscue patterns were made by Chinese-speaking children, that is, Having Similarity with Target Word, Utilizing Names in Word Recognition, Sound-Graphic correspondence, and Sound-Graphic Noncorrespondence. It was found that the category of Having Similarity with Target Word had the highest rate of miscue patterns across ages (except age six) and across conditions. In the miscue pattern of Having Similarity with Target Word, the subjects utilized the rules of the internal qualities of characters, i.e., Stroke Contrast by Feature, Character Contrast by Strokes, and the Manner of Stroke Attachment to read the unknown or unfamiliar characters. For instance, 象, xiàng, 'elephant' was read by four children for 家, jiā, 'home'; 牛, niú, 'cow'; 午, wǔ, 'noon'; and 五, wǔ, 'five' were read by the children for 年, nián, 'year'.

In addition, it was found that across ages and conditions children tacitly utilize a set of rules—the internal qualities of characters with the lexical cues, including the component number and the spatial composition of components—to guess words. For instance, 色, sè, 'color' was substituted by children for 爸, bà, 'Dad'. 色 and 爸 both have the characteristics of two components and vertical composition of components. Moreover, the upper part of 爸 -- 父 is relatively visually similar with the upper part of 色 -- 女, in the characteristics of stroke feature and the manner of stroke attachment. The example is much the same as 象, xiàng, 'elephant' for 家, jiā, 'home'. Another example is 牛, niú, 'cow'
substituted for 年, nian, 'year'. The figure of 十 is relatively similar with the lower part of 年 -- 十 in the characteristics of stroke feature, the manner of stroke attachment and character contrast by strokes.

Furthermore, the constructive pattern of Having Similarity with Target Word was studied in order to understand the implicit systematic cues children used in word recognition across conditions. It was found that the category of Having Similarity with Some Components had the highest rate of miscue patterns across ages (except age three) and across conditions (except the condition of Reading Words). The category of Having One Identical Component was the second highest pattern, then the category of Having Distinguishing Features, and Homonym. In other words, the methods of tackling unknown characters/words by young Chinese children were to identify the known part, e.g., 媽, mā, 'Mom' was read as 鴨, īā, 'duck', based on the distinctive features of characters, or to relate to known parts within those characters/words, e.g., 洗, xī, 'wash' was read as 法, fǎ, 'a last name'.

Comparing and contrasting the data of the character learning in early writing and word recognition in this study reveal that young Chinese children apparently utilized the visual rules to test their hypotheses in order to approximate the conventional system. These same constructive characteristics were found in invented writing and erroneous responses of reading. This would suggest that young Chinese children tacitly regulate and employ a set of rules to cope with the
logographic writing system.

In the miscue pattern of Having Similarity with Target Word, it was revealed that, in general, children utilized a set of visual cues to predict words across ages and conditions, while in specific situations, children responded to the normal and abnormal (pseudo and highlighted) words differently in manner. Additionally, there was a gradual developmental difference in utilizing the visual cues in character recognition across ages. In reading normal characters, the children tended more realistically to focus on the cues and gave more close and careful answers than in reading abnormal characters. In other words, children utilized the same cues to read normal and abnormal characters but in relatively different manners to cope with different tasks. Due to the scope of the study, the effect of tasks on the reading manner displayed was not further studied, although the nature of task appeared to have some effect. This effect might be an interesting topic for further study.

Another important finding from examining the erroneous responses on Reading Isolated Words was that there were no erroneous responses by six-year-olds. This suggests that the six-year-old Chinese-speaking children in this study did not take risks to guess unknown characters. With unknown characters they either kept silent or shook their heads, and simply did not guess.

In the context of Reading Pseudo-words, with known characters, two six-year-olds from the middle class, besides giving correct responses, always pointed to and verbalized the error in the
pseudo-target word to the researcher. For instance, a boy said, "The writing of [Pseudo-word] is wrong. This stroke, \(\downarrow\), has to move to the other side, \(\uparrow\)." A girl said, "If \(\overrightarrow{\text{zhong}}\) were rotated, it would be \(\text{zhong}\), 'middle'.'" On the other hand, to known characters, another three six-year-olds from the lower class just read out the words without any further comment. To unknown characters, all of the six-year-olds from both classes kept silent or shook heads and did not guess. In the context of Reading Highlighted Words, all of the five six-year-olds from both classes either gave correct answers or said, "I don't know." These data provide important evidence that the six-year-olds in this study, regardless of class, did not take risks to predict unknown characters across reading conditions. Secondly, six-year-olds from the middle class revealed notable metalinguistic awareness on the graphic figures, i.e., stroke position, the manner of stroke attachment, spatial composition of components, and character spatial position such as rotation, mirror writing, etc. Six-year-olds from the lower class might also have significant metalinguistic awareness on the graphic figures, but they did not verbalize about them. These phenomena are interesting enough to warrant further study.

The finding on the developmental difference among ages reveals that six-year-olds in this study did not take risks to predict unknown characters/words. In addition, the erroneous responses on the pattern of Similarity demonstrated that the older children tended to be able to compare and contrast similarities from components of characters,
having one identical component, as in characters, 色, 'color' for 爸, 婆, 'Dad'; and 象, 象, 'elephant' for 家, 家, 'home', and having similarity with some components instead of from global configuration, i.e., having distinguishing features, as in characters, 牛, 牛, 'cow' and 午, 午, 'noon' for 年, 年, 'year'. This might suggest that the older the children were, the more lexical cues they utilized simultaneously to guess characters.

In the miscue patterns of word recognition, the pattern of Utilizing Names in Word Recognition was the second highest strategy (16.5%) across ages and conditions. This reveals that Chinese young children before age six tended pragmatically to utilize their most highly familiar words, generally their last and/or first names, to identify those characters which shared some similarity in composition. For instance, a five-year-old girl identified 洗, 洗, 'wash' as 法, 法, 'her last name'. 洗 and 法 both contain two components and the same radical part-- 亠. The spatial composition of components both are horizontal. In addition, the number of strokes, the stroke feature, and the manner of stroke attachment are very similar. Another example is 媽, 媽, 'Mom' identified as 鳳, 鳳, 'phoenix', which is a three-year-old girl's sister's first name. The inside of 鳳, 鳳, is visually similar with the right part of 媽, 媽, 'Mom'-- 馬, 馬, 'horse', in the number of strokes, the stroke feature, and the manner of stroke attachment.

Furthermore, the pattern of the Sound-graphic Correspondence or Noncorrespondence was found in the erroneous responses in word
recognition across ages and conditions, particularly in ages three and four. In the pattern of Sound-graphic Correspondence, sound corresponds with graph one to one in a syllable without any visual distinguishable features based on the category of internal qualities of characters and the lexical cues. For instance, 頭, tóu, 'head,' was confused with 年, nían, 'year'; and 漢, mò, 'silent' with 手, shǒu, 'hand.'

In the pattern of Sound-graphic Noncorrespondence, sound did not correspond with graph in a syllable on a one to one basis. For instance, 小白兔, xiǎo-bái-tù, 'small white rabbit,' three syllabic characters, was substituted for 我, wǒ, 'I,' one syllabic character; 牙齿, yá-chǐ, 'teeth,' two syllabic characters, for 星, xīng, 'star,' one syllabic character. No evidence of this pattern was found for five-year-olds across conditions. The data reveal that awareness and ability to recognize sound-graphic correspondence was well developed by age five in this study, while it was emerging at ages four and three.

What strategies are used by Chinese-speaking children in early writing/spelling and reading? What developmental differences, if any, exist?

Examination of the data on early writing and Reading a Story Book reveals that during the early stages of becoming literate, young children began to gain control over basic concepts about the organization of surface features of written language and books. They learned how to handle the conventional format of books and written
language through reading. In writing they wrote or invented writing in order to convey meaning; in reading they read, or utilized picture clues to read. In general, in writing, Chinese young children in this study utilized semantic, visual, pragmatic, and phonetic strategies simultaneously; in reading a text they might utilize semantic and syntactic strategies, not a sound-graphic strategy. It needs to be pointed out, however, that the definition of phonetic strategy in analyzing writing data and the definition of sound-graphic strategy in analyzing the transcript of Reading a Story Book were different. The former is based on the concept of the Chinese logographic writing system, while the latter is based on the concept of the English alphabetic writing system because of using The Reading Miscue Inventory (Goodman and Burke, 1972) as the coding taxonomy.

Strategies in Early Writing by Age

Examination of the thirty-eight writing protocols reveals that the visual strategy was utilized at the highest rate by all ages across the writing conditions. The visual strategy use was followed, in order, by the frequent use of the phonetic strategy, drawing strategy, and pragmatic strategy. In employing the visual strategy, children across ages tended to use the lexical cues and the internal qualities of characters to invent a character, as was discussed in the preceding section of miscue patterns in early writing by age.

The use of drawing strategy as drawing iconic pictures on characters and the use of a pragmatic strategy as using one's last or first name on every character were utilized frequently by
three-year-olds in this study, occasionally by five-year-olds and not at all by four- or six-year-olds. This finding suggests that even as young as three, children potentially intend to mean in writing. In addition, the findings also reveal the close relationship between drawing and early writing. Vygotsky (1978) stated that drawing is the primary symbolic representation of written language in order to signify something. Children’s drawing is a preliminary stage in the development of writing.

It needs to be pointed out that the use of the phonetic strategy by Chinese-speaking children in this study is quite different than its use by English-speaking children. The phonetic strategy in English-speaking children is based on letter-sound graphophonemic correspondence, such as U for YOU, TRK for TRACK, while the phonetic strategy employed by Chinese-speaking children is to utilize phonemic symbols, i.e., ㄅ, ㄆ, ㄇ, ㄈ, etc. to spell out the sound of a character, which is not character-sound graphophonemic correspondence. For instance, 星, xīng, ‘star’ was written as ㄫ.

The other phenomenon that occurs in the use of the phonetic strategy is the use of a homonym that has the same sound as the intended word but has a different graph and meaning. For instance, 中, zhōng, ‘middle’ was written as 忠, zhōng, ‘loyalty’. 中, zhōng, ‘middle’ is the phonetic part of 忠, zhōng, ‘loyalty’ and 心, xīn, ‘heart’, the lower part of 忠, zhōng, ‘loyalty’ is the signific/radical part of 忠, zhōng.
Using phonemic symbols to spell unknown characters or to construct texts was shown only by six-year-old first graders in this study and might illustrate the influence of phonemic symbol training in schooling. In addition, confusion among homonyms was also shown by six-year-olds in this study. This might be due to the complexity of the internal construction of Chinese orthography, that is, compound forms, particularly the signifier-phonograph such as 中, zhōng, 'middle' with 心, zhōng, 'loyalty', are constructed from combining single forms for radical and phonetic parts. The phenomenon of homonym use by six-year-olds in this study seems to or could indicate that the more experience with written language the child has, the more linguistic awareness develops. The linguistic awareness appearing in this study is an important topic for further study.

In general, the data reveal that three-, four-, five-, and six-year-old Chinese-speaking children in this study utilized semantic (e.g., drawing), visual, pragmatic, and phonetic strategies simultaneously and in an integrated manner in writing. The findings in this study support the findings of Clay (1975) and Harste, Burke, and Woodward (1983) across writing systems.

Strategies in Early Reading by Age

In examining the data of Reading a Story Book, three types of reading styles emerged which are descriptive of young Chinese children's reading attitude and strategies. These were conventional reading, reading by picture cues, and reading from the back page.
When the researcher handed the story book, 我的一天, wǒ de yī tiān, 'My One Day', to the child backward and upside down and asked the child to read, seven of the nineteen children (36.84%) across ages read from the back page forward. They pretended to read or read the book by making up a story to fit the pictures, moving from the back of the book to the front. An additional seven of the nineteen (36.84%) also pretended to read by making up a story to fit the pictures, but moved from the front of the book to the back page. The remaining five (26.32%) read the book word by word, column by column, and page by page in conventional reading style.

Examination of the data on reading styles by ages reveals that in general five- and six-year-olds knew how to handle a book more than three- and four-year-olds did. Moreover, it was also found that there was a change of about 50% among the ages of four, five, and six in reading style. The difference might be due to the fact that five- and six-year-olds have more book experience than three- and four-year-olds do, and to the fact that six-year-olds have received formal reading instruction in school, while four- and five-year-olds have not.

 Concurrently, the Chinese-speaking children's knowledge of the book title was also explored. Only 25% of the twelve subjects read the title page. None of the 19 subjects cared about and/or read the author's name. In addition, the data reveal that there was no developmental difference between the ages of three and four in reading the title page, while an about 25% difference occurred among the ages of four, and five, and six. The data might suggest that in formal
language instruction in Taiwan, the title page and authorship are not emphasized, but this requires further investigation.

One of the main findings on conventional reading style is that no miscue in sound/graphic relationships appeared in this study, which was analyzed by the instrument of The Reading Miscue Inventory (Goodman and Burke, 1972) based on the English alphabetic writing system. This might not mean that subjects perfectly utilized the cueing system of sound/graphic relationships in reading the story book; rather it might mean that in this study the cueing system of sound/graphic relationships used in the RMI did not warrant the analyses. The reason could well be due to the different nature of Chinese and English languages.

This could be because the English alphabetic writing system is largely morphophonemically based, while the Chinese logographic writing system is morphemically and iconically based. As a sound-writing script, alphabetic systems map onto speech at the level of morphophoneme (Chomsky and Halle, 1968), while the logographic system codes the unit of speech at a morphemic-syllabic level. In general, Chinese orthography represents a lexical morpheme without overt reference to its phonological or phonetic form (Chao, 1968).

Evidently, in the task of Reading a Story Book, children either utilized their implicit syntactic and semantic knowledge to read an unfamiliar text or utilized the picture clues to invent a story text. And/or, it might be because of the display of the phonemic symbols correspondently beside each character in the story book. The first
graders in this study could well have utilized the phonemic symbols as a phonetic aid to sound out unknown characters. This needs to be further studied.

Additionally, in the reading process, the miscue patterns of substitution, omission, and repetition (i.e., correcting a miscue) appeared, but insertion and reversal did not. For instance, a five-year-old substituted a verb in the following sentence:

我會換衣服。
Wǒ huì huàn ō-fú.

I can put on my clothes.
The substitution of 穿, chūan, 'put on' for 換, huàn, 'chang' is grammatically and semantically acceptable. This might suggest that Chinese young children occasionally take risks, seek meaning, test hypotheses, and reconstruct meaning during the reading procedure.

However, due to the low percentage (less than 1%) of miscues in the task of Reading the Story Book, discussion of the reading strategies, i.e., the grammatical and semantic strategies, the syntactic/semantic and the sound/graphic relationships, and confirming, in reading a story book is not warranted. This needs to be further studied.

In conclusion, this study provides evidence that young Chinese children sampled across all ages do employ a set of identifiable abstract visual rules, i.e., the number of strokes, the number of components, the spatial composition of components, stroke contrast by feature, character contrast by strokes, and the manner of stroke
attachment, to construct characters in writing/spelling and to test characters in word recognition without any formal instruction. In addition, in the literacy process, they do develop their own systems and structures that are not conventional but are logical and identifiable. The findings in this study support the innate-constructivist paradigm of language learning across writing systems, i.e., English, Spanish, and Chinese.

It was generally thought that because of the different characteristics of Chinese and English in spoken and written language, the constructive patterns and learning strategies of beginning learners may be different. Beginning readers in different writing systems may face different learning tasks when they learn how to read and to write printed symbols constructed on different principles. On the other hand, however, there have been proposals (e.g., Chomsky, 1965; McNeill, 1966; Slobin, 1973) that certain linguistic structures are universal, and that certain universal cognitive abilities are likely to be involved in language learning.

This study did perhaps find certain universals in terms of developmental stages of early writing among young Chinese and American children. That is the early invented writing across writing systems is first dominated by visual features of script, but which differ in characteristics due to the difference of orthography. Then awareness and development of the phonetic features of script occur. In addition, development in early writing across writing systems progresses from global to more differentiated features of script, but
does not progress in a "perfect" linear sequence, rather with limited regression.

On the other hand, this study also finds certain differences across writing systems in terms of the orthographic cueing systems, the constructive patterns and the learning strategies of beginning learners. In English, a morphophonemic orthography, young English-speaking children pair spellings with segments abstractly categorized in terms of a hierarchy of articulatory features, while in Chinese, a morphemic and iconic orthography, young Chinese-speaking children pair writing/spellings with segments abstractly categorized in terms of global visual features.

Although the findings in this study support the findings of Clay (1975) and Harste et al. (1981, 1983) across writing systems, that is, young children utilize semantic, visual, pragmatic, and phonetic strategies simultaneously and in an integrated manner in reading and writing, the use of phonetic strategy by Chinese-speaking children is quite different from its use by English-speaking children. The phonetic strategy in English-speaking children is based on letter-sound graphophonemic correspondence, such as U for YOU, FRND for FRIEND, while the phonetic strategy employed by Chinese-speaking children is to utilize phonemic symbols, i.e., ㄅ, ㄆ, ㄇ, ㄈ, etc., to spell out the sound of a character, which is not character-sound graphophonemic correspondence, and/or to use a homonym to sound out the intended character, which has a different graph and meaning.
In summary, this study seems to support the notion that the learning processes are similar in general due to the similarity of the basic cognitive structure, but different in specific features due to the variety of the culture and language. In the early literacy learning processes, the cognitive strategies, e.g., utilizing abstract identifiable rules and constructing systematic patterns, and the developmental patterns of early writing are similar in Chinese and English. On the other hand, the phonetic strategy in early reading and writing is different across the writing systems.

Recommendations for Future Research

Some recommendations have already been make in the preceding discussion, but several more are offered here.

The first recommendation for future research would be to conduct a similar study with an enlarged sample size in order to discern whether the visual features, the orthographic cues and the miscue patterns in lexicon found in this study could be generalized to more Chinese-speaking children.

The second research recommendation would be to conduct experimental studies to overcome the limitations of this naturalistic study in early spelling/writing.

Experimental studies might overcome two fundamental limitations of the inferences from the invented spellings. The most important is that the spelling problems posed by the standard alphabet and letter-names are limited to certain cases, so that no general description of children's phonetic categories can be constructed on the basis of the invented spelling. Second, in our society only a small minority of children create their own spellings, giving rise to a suspicion that the underlying judgments may be limited
It was also found from this study that in this sample not every child creates his/her own writing/spelling and takes risks to guess in word recognition. They did so in this study, through the encouragement of the researcher, which introduced an element of reactivity. In order to overcome the limitation of this factor for validity, controlled experimental studies seem to be essential.

The third recommendation would be to conduct longitudinal studies. An in-depth study of children's writing/spelling and reading over a period of time would provide a great deal of information about how the cues and miscues show developmental differences and similarities across individuals as they approach literacy.

A fourth recommendation would be to study the acquisition of metalinguistic awareness of the graphic figures and sound-graphic relationships that appears to occur in six-year-olds. The information produced by such a study could help us to understand how children learn abstract concepts and relationships of language systems.

Finally, an important recommendation would be that The Reading Miscue Inventory (Goodman and Burke, 1972) used to analyze the data of Reading a Story Book be adapted in order to cope with the different task demands imposed by different orthographies, particularly with respect to sound-graphic relationships. The concept and task of sound-graphic relationships are very different in English alphabetic and Chinese logographic writing systems. The sound-graphic relations in English deal with letter-sound graphophonemic correspondence, while
based on the findings of this study the sound-graphic relations in Chinese deal with character-sound graphosyllabic correspondence, using phonemic symbols to spell out the sound of character, and using homonyms. This area needs to be further studied.
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THE DESIGN OF THE STUDY

- Research Questions: Early Reading and Writing/Spelling in Word/Character Level
- Linguistic Analysis: Chinese Orthography

Instrument

- Task 1: Uninterrupted Writing
- Task 2: Dictated Writing
- Task 3: Reading of Isolated Words
- Task 4: Reading a Book

Coding System

- Taxonomy 1 → Taxonomy 2 → Taxonomy 3

Analysis of Data

- Finding 1
- Finding 2
- Finding 3

Discussion: Early Reading and Writing/Spelling in Word/Character Level

→ The arrow indicates origination.
APPENDIX B
THE READING MISCUE INVENTORY
## Reading Miscue Inventory Coding Sheet

<table>
<thead>
<tr>
<th>Question</th>
<th>Percentage</th>
<th>Column Total</th>
<th>Pattern Total</th>
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<tr>
<td>Dialect 1</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Intonation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Graphic Similarity</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sound Similarity</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grammatical Function</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Correction</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grammatical Acceptability</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Semantic Acceptability</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meaning Change</td>
<td>9</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Miscue Number

- No Loss
- Partial Loss
- Loss

### Comprehension

- Strength
- Partial Strength
- Weakness
- Overcorrection

### Dialect 1

- Intonation

### Intonation

- Graphic Similarity

### Sound Similarity

- Grammatical Function

### Correction

- Grammatical Acceptability

### Semantic Acceptability

- Meaning Change

### Meaning Change

- No Loss
- Partial Loss
- Loss

### Comprehension

- Strength
- Partial Strength
- Weakness
- Overcorrection
<table>
<thead>
<tr>
<th>Place of Articulation</th>
<th>Unaspirated Stops</th>
<th>Aspirated Stops</th>
<th>Unaspirated Affricates</th>
<th>Aspirated Affricates</th>
<th>Nasals</th>
<th>Fricatives</th>
<th>Vowels</th>
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<tr>
<td>Bilabial</td>
<td>p</td>
<td>p</td>
<td>m</td>
<td>m</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labio-dental</td>
<td>d</td>
<td>t</td>
<td>s</td>
<td>s</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dental-alveolar</td>
<td>t</td>
<td>t</td>
<td>t</td>
<td>t</td>
<td>n</td>
<td>n</td>
<td>l</td>
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<td>Retroflexes</td>
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<td>l</td>
<td>s</td>
<td>s</td>
<td>r</td>
<td>r</td>
<td></td>
</tr>
<tr>
<td>Palatal</td>
<td>l</td>
<td>l</td>
<td>p</td>
<td>s</td>
<td>p</td>
<td>p</td>
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<tr>
<td>Velar</td>
<td>k</td>
<td>k</td>
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<td>h</td>
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<table>
<thead>
<tr>
<th>Tones</th>
<th>Description</th>
<th>Pitch</th>
<th>Graph</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>high level</td>
<td>55</td>
<td>.Resources[1]</td>
<td>yi 'clothes'</td>
</tr>
<tr>
<td>2</td>
<td>high rising</td>
<td>35</td>
<td>.Resources[1]</td>
<td>yi 'to suspect'</td>
</tr>
<tr>
<td>4</td>
<td>high falling</td>
<td>51</td>
<td>(Resources[1])</td>
<td>yi 'meaning'</td>
</tr>
</tbody>
</table>
APPENDIX D

FREQUENCY DISTRIBUTION OF CHARACTERS BY NUMBER OF STROKES IN CHUANG'S LIST AND LEONG'S LIST
### Frequency Distribution of Characters by Number of Strokes in Chuang's List and Leung's List. *

<table>
<thead>
<tr>
<th>Number of strokes</th>
<th>Chuang's list</th>
<th>Leung's list</th>
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</thead>
<tbody>
<tr>
<td>30</td>
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<td></td>
</tr>
<tr>
<td>29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td></td>
<td></td>
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<tr>
<td>27</td>
<td>4</td>
<td>2</td>
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<td>26</td>
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<td>3</td>
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<tr>
<td>25</td>
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<td>2</td>
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<tr>
<td>24</td>
<td>16</td>
<td>5</td>
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<td>23</td>
<td>11</td>
<td>10</td>
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<td>22</td>
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<td>21</td>
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<td>20</td>
<td>42</td>
<td>23</td>
</tr>
<tr>
<td>19</td>
<td>53</td>
<td>39</td>
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<tr>
<td>18</td>
<td>72</td>
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<tr>
<td>17</td>
<td>105</td>
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<td>91</td>
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<td>4</td>
<td>74</td>
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<td>3</td>
<td>34</td>
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<td>2</td>
<td>15</td>
<td>13</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

\[ N = 2830 \quad 1851 \]

\[ M = 11.61 \quad 11.27 \]

\[ SD = 4.43 \quad 4.45 \]

*The distribution is interesting and is almost symmetrical. This mean stroke number of 11 to 12 \( \pm 4 \) is significant and is probably the heme for optimal visual cues in the perception of Chinese characters.*
DIRECTIONS FOR OBSERVER IN THE TASK OF UNINTERRUPTED WRITING

1. Using observation sheet, record with blue pencil each item produced by the child, placing it in an appropriate section of Observation Sheet.

2. Number each item designating sequence of production.

3. Note any significant behaviors or comments of the child in relationship to the item produced.

--------------During child's re-reading--------------

4. Record with red pencil each item read by the child, placing notation above appropriate text (blue) item.

5. Number each item read, designating sequence of production.

6. Note any significant behaviors or comments of the child in relationship to the item produced.
THE LIST OF DICTATED CHARACTERS IN SENTENCES

大：“大家好”的“大”。
爸：“爸爸回来3”的“爸”。
妈：“妈妈在煮饭”的“妈”。
中：“我坐在中间”的“中”。
高：“我长高了”的“高”。
我：“我很可爱”的“我”。
手：“我有两只手”的“手”。
星：“天上的星星一闪一闪”的“星”。
牙：“我的牙齿很白”的“牙”。
小：“我的个子很小”的“小”。
年：“新年快乐”的“年”。
床：“妹妹已上床睡觉了”的“床”。
洗：“洗手后再吃东西”的“洗”。
天：“我天天上学”的“天”。
家：“我家住木栅”的“家”。“
大爸 媽 中 高 我 手
星 牙 小 年 床 洗 天 家

READING LIST OF PSEUDO-WORDS (FROM LEFT TO RIGHT)
大 爸 驗 哥 高 爸 手
星 牙 小 年 床 洗 天 家

READING LIST OF HIGHLIGHTED WORDS (FROM LEFT TO RIGHT)
大 爸 媽 中 高 我 手
星 牙 小 年 床 洗 天 家
TWO SAMPLE PAGES OF THE STORY BOOK—MY ONE DAY

[Image of two cartoon panels showing a character brushing teeth and drinking from a cup.]

[Chinese text below the panels.]
THE ORDER AND SCHEDULE OF RESEARCH TASKS

Day 1

* Uninterrupted writing
* Dictated writing words/characters

Day 2

* Reading words/characters--Condition 1 (reading and asking questions)

Day 3

* Reading pseudo-words/characters--Condition 2
* Reading a book and retelling the story

Day 4

* Reading highlighted words/characters--Condition 3

DATA COLLECTION SCHEDULE

<table>
<thead>
<tr>
<th>Duration</th>
<th>Activity Description</th>
<th>Subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 day</td>
<td>Orient videotape group</td>
<td>2 research assistants</td>
</tr>
<tr>
<td>4 days</td>
<td>Videotape 1st group</td>
<td>5 subjects</td>
</tr>
<tr>
<td>4 days</td>
<td>Videotape 2nd group</td>
<td>5 subjects</td>
</tr>
<tr>
<td>4 days</td>
<td>Videotape 3rd group</td>
<td>5 subjects</td>
</tr>
<tr>
<td>4 days</td>
<td>Videotape 4th group</td>
<td>4 subjects</td>
</tr>
<tr>
<td>1-2 days</td>
<td>Catch-up videotape session for any children who was ill in last taping group.</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX F

SAMPLE OF THE NARRATIVE TRANSCRIBING SHEET OF READING A STORY BOOK
My One Day

天亮了，
The sky has brightened,

我起床。
I get out of bed.

我换衣服。
I can put on my clothes.

我刷牙。
I can brush my teeth.

我洗脸。
I can wash my face.

我自己玩。
I play by myself.

我和朋友玩。
I play with friends.

我爱听故事。
I love to listen to stories.
我的一天
Wǒ de yī tiān
My One Day

1501
我喜歡洗澡。
Wǒ xǐ-huàn xǐ-zǎo.
I like to take a bath.

1601
營養的食物，
Yǐng-yǎng-de shí-wù，
Nutritious food,

1602
使我長得高，
shǐ wǒ zhǎng de ɡāo，
it makes me grow taller,

1603
長得壯。
zhǎng de zhuānɡ.
grow stronger.

1901
爸爸晚安！
Bà-bà wǎn-ān:
Daddy goodnight:

1902
媽媽晚安！
Mā-mā wǎn-ān:
Mommy goodnight:

1903
星星晚安！
Xīng-xīng wǎn-ān:
Stars goodnight:

1904
大家晚安！
Dà-ziā wǎn-ān:
Everyone goodnight!