LITERACY AND METALINGUISTIC AWARENESS: A CROSS-CULTURAL STUDY

by

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Abstract

This dissertation examines the role of literacy in children's acquisition of metalinguistic awareness. It is argued that writing provides children with a set of linguistic categories that are used to reflect on spoken language. Two implications of this hypothesis are: 1) children's understanding of certain metalinguistic concepts will be mediated by their understanding of these concepts as units of text, and 2) children from cultures with qualitatively different scripts will demonstrate corresponding differences in their acquisition of metalinguistic awareness. These claims were investigated in two studies. In the first study, children's (aged 4 to 6 years) understanding of "word" as a piece of written text was found to predict their awareness of "word" as a unit of speech. In the second study, English-speaking Canadian and Mandarin-speaking Chinese children's understanding of the metalinguistic concepts of word (the most salient feature of English script) and character/syllable (the most salient feature of Chinese script) was investigated. It was hypothesized that children would first be aware of the linguistic concept which is most salient in their culture's writing system. Children (aged 4 to 6 years) from both countries were given a speech-based set of tasks that asked them to segment spoken language into i) words and ii) syllables/characters, and a text-based set of tasks that asked them to identify i) words and ii) syllables/characters in writing. All children received all four sets of tasks (i.e., text-word, text-syllable/character, speech-word, and speech-syllable/character). The results indicated that children were significantly more aware of

the linguistic concept that is represented in their culture's writing system. Furthermore, in both countries, children's ability to segment speech was significantly correlated with their understanding of text. One cultural difference, however, was that while none of the English-speaking children demonstrated an awareness of word in speech without knowing words as units of text, some of the Mandarin-speaking children demonstrated an awareness of characters in speech without being able to identify characters in text. The results are discussed in terms of a proposed multi-factor model of metalinguistic awareness in which language acquisition, cognitive development (particularly cognitive control), and literacy uniquely contribute to children's abilities to think about language.

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Table of Contents

Abstract ii

Acknowledgements iv

List of Tables viii

List of Figures x

Chapter 1: Theoretical Review

Overview 1

Theories of Metalinguistic Awareness 3

Piagetian and Neo-Piagetian Theories 4

Piaget: On awareness 4

Hakes: Awareness of Language 7

Bialystok: Analysis and Control Model 8

Karmiloff-Smith: RR Model 10

The Cognitive Effects of Literacy 12

Literacy and Metalinguistic Awareness 14

Vygotsky 14

Olson: Model Theory of Literacy 15

Children's Acquisition of Literacy 18

Chapter 2: Proposed Model and Hypotheses

A "Multi-factor" Model of Metalinguistic Awareness 22

Design and Hypotheses 25

Chapter 3: Study 1 - Literacy and Children's Understanding of "Word"

Introduction 28

Children's Acquisition of the Concept of Word 30

The Role of Literacy 32

Children's Early Literacy Understanding 35

Design and Hypothesis of Study 1 36

Method 37

Subjects 37

Procedure 38

Results 39

Developmental Differences 39

Relation of Text- and Speech-based Tasks 42

Discussion 46

Chapter 4: Study 2 - Literacy and Metalinguistic Awareness in Canadian and Chinese Children

Introduction 48

The Chinese Writing System 49

Literacy Acquisition in China 50

Metalinguistic Awareness in Chinese Speakers 53

Design and Hypotheses of Study 2 57

Method 60

Subjects 60

Procedure 60

Scoring 64

Results 65
Control Tests 65
Cross-Cultural Analyses 65
Discussion 93

Chapter 5: General Discussion

Summary of Findings 101
Relation of Findings to Theories of Metalinguistic Awareness 103
Future Directions for Research 105
Relation of Findings to Theories of Cognitive Development 108
Summary 109
References 111

Appendices

Appendix A: Protocols for Study 1 119
Speech-Based Tasks 119
Text Based Tasks 123
Appendix B: Protocols for Study 2 124
Word Tasks 124
Syllable/Character Tasks 127
Appendix C: Task Order Lists for Study 2 130
Appendix C: Task Order List for Study 2 130
Appendix D: Statistical Analyses of Control Variables in Study 2 131

List of Tables

Table 1. Developmental Milestones in the Multi-Factor Model of Metalinguistic Awareness 25

Table 2. Age-Group Differences on Mean Score for Concept of Word Tasks 41

Table 3. Correlations for Children's Age (in months) and Total Scores on each Task 43

Table 4. Hierarchical Regression Analysis for Age and Literacy Predicting Speech-based Concept of Word Score 45

Table 5. Mean Percent Correct (sd) on Metalinguistic Awareness Tasks by Country, Linguistic Concept, Medium, and Age Group 66

Table 6. Repeated-Measures ANOVA for Metalinguistic Awareness (Age Group x Culture/Script x Linguistic Concept x Medium) 67

Table 7. Mean Percent Correct (sd) on Metalinguistic Awareness Tasks (Contrastive Stimuli only) by Country, Linguistic Concept, Medium, and Age Group 72

Table 8. Repeated-Measures ANOVA for Metalinguistic Awareness - Contrastive Stimuli only (Age Group x Culture/Script x Linguistic Concept x Medium) 73

Table 9. Mean Percent Correct (sd) on Metalinguistic Awareness Tasks (Contrastive Stimuli only) by Country, Linguistic Concept, Medium, and Age Group (Late Educated Chinese Children only) 76

Table 10. Repeated-Measures ANOVA for Metalinguistic Awareness (Contrastive Stimuli) -- Excluding Chinese Children with Early Literacy Training (Age Group x Culture/Script x Linguistic Concept x Medium) 78

Table 11. Correlation Matrix for Children's Age (in months) and Total Scores on "Word" Tasks for Canadian Children 85

Table 12. Correlation Matrix for Children's Age (in months) and Total Scores on "Syllable" Tasks for Canadian Children 85

Table 13. Hierarchical Regression Analysis for Age and Awareness of Text Predicting Speech-based Concepts, Word and Syllable: Canadian Children 86

Table 14. Correlation Matrix for Children's Age (in months) and Total Scores on "Word" Tasks for Chinese Children 91

Table 15. Correlation Matrix for Children's Age (in months) and Total Scores on "Character" Tasks for Chinese Children 87

Table 16. Hierarchical Regression Analysis for Age and Awareness of Text Predicting Speech-based Concepts, Word and Character: Chinese Children 88

Table 17. Correlation Matrix for Chinese Children's Age (in months), Literacy Education, and Speech-based Metalinguistic Awareness Tasks 91

Table 18. Regression Analysis for Age and Literacy Education Predicting Performance on Speech-based Metalinguistic Awareness of Word 92

Table 19. Regression Analysis for Age and Literacy Education Predicting Performance on Speech-based Metalinguistic Awareness of Character 92

List of Figures

Figure 1. Mean percent correct by age group for each metalinguistic task 43

Figure 2. Page from a lesson book (Lessons 5 and 6 of "Recognizing Hanzi" pages 32-33 from volume I-1, People's Educational Publications, 1989) 52

Figure 3a. Metalinguistic Awareness by Concept by Age for Canadian Children 70

Figure 3b. Metalinguistic Awareness by Concept by Age for Chinese Children 71

Figure 4a. Metalinguistic Awareness by Concept by Age for Canadian Children (Contrastive Stimuli) 81

Figure 4b. Metalinguistic Awareness by Concept by Age for Chinese Children (Contrastive Stimuli) 81

Figure 5a. Metalinguistic Awareness by Concept by Medium by Age: Canadian Children 83

Figure 5b. Metalinguistic Awareness by Concept by Medium by Age: Chinese Children 83

Figure 6. Metalinguistic Awareness in Chinese Children by Linguistic Concept for each Age/Education Group 90

Chapter 1: Theoretical Review

Overview

From an early age, most children are competent members of a linguistic community; even two-year-olds are able to produce simple two-word utterances and understand more complex sentences. Although this early competence demonstrates an understanding of language, it is an implicit understanding. Explicit understanding of language *as language*, or *metalinguistic awareness*, is not found in children until they are older – typically sometime around 6 to 8 years of age.

Although metalinguistic awareness is often thought of as a single ability, the age at which children are considered to demonstrate metalinguistic awareness differs greatly from study to study and depends on factors such as the type of knowledge being tested for and the extent to which the knowledge is required to be explicit. Researchers have tended to make general claims from studies that focus on a single aspect of metalinguistic awareness. This, in part, explains why there has been such variation in the explanations of how children become metalinguistically aware. In fact, "metalinguistic awareness" may be too general to be of much empirical use – it may be more appropriate to think of metalinguistic awareness as a general area of knowledge and for research to focus on specific types of metalinguistic understanding.

Perhaps the form of metalinguistic awareness most frequently investigated is phonemic awareness. Because even very young children will play with word sounds, some awareness of the phonemic properties of speech must be present at an early age--even two-year-olds will play "language games" in which they say similar sounding words

(Weir, 1962). However, young children perform poorly on tasks that require a more systematic analysis of phonology. For example, children are not able to compare the initial phonemes of words until 5 years of age (Kirtley, Bryant, MacLean, & Bradley, 1989) and most children can not explicitly manipulate phonemes in words (e.g., "Say 'fish' without the /f/,") until a year or so later (Magnusson & Naucler, 1993).

Numerous studies have also investigated children's awareness of grammatical rules. As with other forms of metalinguistic awareness, there are dramatic differences in what has been deemed to indicate an awareness of grammatical rules; studies have varied greatly in the extent to which the knowledge that they have tested for has been required to be explicit. What has been taken as evidence for grammatical awareness has varied from making spontaneous repairs in speech (Karmiloff-Smith, 1979; Karmiloff-Smith, 1986), to judging which of two sentences "sounds better" (DeVilliers & DeVilliers, 1972; Gleitman, Gleitman, & Shipley, 1972), to conjugating a word on request (Vygotsky, 1986), to verbally stating the grammatical rule in question (Karmiloff-Smith, 1986). Not surprisingly, children's performance varies according to the degree to which the task requires explicit knowledge.

Another often tested aspect of metalinguistic awareness, and a focus of the current dissertation, is children's understanding of the concept of word. Again, there is variation in the literature as to what is accepted as indicating metalinguistic awareness in this domain. For example, in one of the first empirical investigations of children's understanding of *word*, Downing and Oliver (1974) asked children to identify words from among a series of auditory stimuli and found that, although all of the children overextended the use of *word*, the youngest group (4;5 to 5;5) did so significantly more

then did the older children (5;6 to 8;0). In another study, Bialystock (1986a) gave children a variety of Piagetian style tasks (e.g., asking children to judge which of two spoken words is bigger: *train* or *caterpillar*) and found that there was a significant improvement in children's understanding of word from JK to Grade 1. More recently, in an attempted to capture a more implicit understanding of word, Karmiloff-Smith (Karmiloff-Smith, Grant, Sims, Jones, & Cuckle, 1996) asked children to "repeat the last word" said by an experimenter and found that children as young as 4-years-old have some success on this task.

The theories that have attempted to explain children's acquisition of metalinguistic awareness have also varied greatly. One reason for this is that theories have been based on research that focused on only a small component of metalinguistic awareness. Another reason, as will be clear in the review below, is that researchers vary in what their a priori assumptions are about the nature of metalinguistic awareness.

Theories of Metalinguistic Awareness

A majority of the theories on children's acquisition of metalinguistic awareness have been from a Piagetian or neo-Piagetian perspective. These theories suggest that metalinguistic awareness is either a part of more general cognitive development (e.g., Hakes, 1980; Piaget, 1929; Sinclair, 1978) or an aspect of language acquisition (e.g., Bialystok, 1993; Karmiloff-Smith, 1992; Smith & Tager-Flusberg, 1982). Recently, however, it has been suggested that literacy plays a critical role in some aspects of metalinguistic awareness (Harris, 1989; Olson, 1994). In the following section, these different theoretical perspectives will be reviewed. A multi-factor model of how metalinguistic awareness develops will then be presented. This model will acknowledge

the role that cognitive development and language acquisition play in children's metalinguistic awareness, but will argue -- drawing from the literacy theories (particularly Olson's *model* theory) -- that literacy is required for some aspects of metalinguistic awareness.

Piagetian and Neo-Piagetian Theories

Piaget addressed the issue of "awareness" in two of his later books, *The Grasp of Consciousness* and *Success and Understanding* (Piaget, 1976; Piaget, 1978). In these books, a distinction is made between implicit, procedural knowledge ("know-how") and explicit, conscious knowledge ("know-that"). Piaget and his colleagues investigated the delay between children's abilities to perform an action ("know-how") and their ability to correctly describe how they performed the action ("know-that"). For example, children were asked to hit a target with a wooden ball using a sling. Although most children could do this by 5 years of age, younger children could not explain how they did it. When asked the position at which they let go of the sling, the youngest children claimed that they let go of the sling when the ball was directly in front of the target; only the older children were aware that they released the ball when it was tangential to the target. Interestingly, there was an intermediate group of children who seemed to formulate "compromise" explanations in which they claimed to have released the ball somewhere between the tangent and directly in front of the target.

These and similar findings provided the basis for Piaget's (1976; 1978) explanation of the relation between knowing how and knowing that. According to Piaget, "know-how" and "know-that" constitute autonomous, yet reciprocally influencing forms of knowledge. Although the basis for "knowing-that" is in children's procedural

knowledge, they are not able to directly access this information; there is no "direct illumination" of the knowledge implicit in their procedural schemas. Instead, the implicit knowledge must be assimilated by coordinating actions and forming new concepts, a process which is "as laborious as if it corresponded to nothing already known by the child... [and] presents the same risks of omissions and distortions as if the subject were required to explain to himself an external system of physical connections" (Piaget, 1976, p. 339).

According to Piaget, the process of children becoming aware proceeds from "the periphery to the centre", by which he means that children's knowledge does not originate in either the "subject" (i.e., the child) or in the "object" (i.e., the world), but instead, from the interaction of the two. Children are first aware of the goals and results of an action and only gradually come to understand the "internal mechanisms" of the action (i.e., the means employed, the reasons for modifying the actions, etc.) (Piaget, 1976, p. 334). Children become aware through a process of abstraction from the level of action. The most basic way that children do this is through the *empirical abstraction* of "observable features" which are "anything that can be recorded through a simple factual (or empirical) observation", for example, the covariance of two events (Piaget, 1976, p. 345). The two other forms of abstraction require children to make "inferential coordinations", which are not directly observable but must be deduced. The first of these is *reflexive abstraction*, in which children are unconscious of the inferences they are making. The second is *reflected abstraction*, in which inferences are made consciously and often involve children intentionally carrying out two or more actions in order to discern common factors.

Piaget (1976) suggested that the processes of abstraction outlined above creates at least three levels of knowledge. The first is "know-how", or "action without conceptualization". At this level, children have "isolated assimilation schemes" which are linked to specific objects. The next level is that of conceptualization, in which the elements of action are derived via reflexive abstraction. It is at this level that concepts are added. The last level, which is contemporaneous with formal operations, involves the addition of reflected abstraction. At this level children are capable of "second-power operations" in which abstractions are made from previous abstractions. Although concepts are derived from actions, there is also a retroactive effect of the concepts on these actions, for example, through planning or devising new actions.

Although Piaget did not directly address the domain of language in his theory of awareness, several researchers have used his theory to explain children's metalinguistic awareness. For example, Sinclair (1978) wrote that Piaget's theory can be applied to explain developments in children's awareness of language by considering language (i.e., speaking) as a behaviour (or action). Piaget's theory of know-how and know-that then apply: speaking is know-how and metalinguistic awareness is know-that. As with other forms of awareness, cognizance of language is theorized to progress from the periphery to the center. For language, this means that children are first aware of the goals and success or failure of their speech-acts and then start to become aware of both the meaning and the form of language as they compare their utterances to their intended meaning and to linguistic regularities (both morphosyntactic and phonetic) which they have noticed (presumably by making *empirical abstractions*). Awareness of language occurs both as

an "interiorization movement concerned with meaning" and as an "exteriorizion movement concerned with form" (Sinclair, 1978, p. 198).

Hakes (1980) also attempted to relate Piaget's model of cognitive development to children's acquisition of metalinguistic awareness. According to Hakes, language developments, including developments in metalinguistic awareness, are continuous with other, more general cognitive developments. Following Piagetian theory, he suggests that the cognitive skills which enable children to engage in metalinguistic activities are the same ones that underlie the transition from pre-operational to concrete-operational thought. More specifically, Hakes claims that, in addition to task-specific knowledge (e.g., knowing the meaning of words and sentences used in a task), the development of metalinguistic awareness involves an increase in the ability to engage in deliberate, controlled activities and, in particular, an increase in the ability to "decenter" (i.e., to mentally "stand back" and simultaneously consider multiple aspects of a situation). These are the skills that Piaget described as being part of "reflected abstraction", which is acquired with the advent of concrete operations. Hakes supports this claim with data showing that children's performance on metalinguistic tasks is correlated with their performance on conservation tasks.

Hakes (1980) has been criticized for his claims that the cognitive abilities required to engage in metalinguistic activities are different from those used in language acquisition, and that it is only in middle childhood, with the emergence of concrete operational functioning, that children acquire these "new ways of dealing with language, ways that are different from and require cognitive abilities that go beyond those involved in understanding and producing utterances" (Hakes, 1980, p. 97). Smith and Tager-

Flusberg (1982) call this view (i.e., that language acquisition and metalinguistic awareness are two distinct cognitive abilities) the "autonomy hypothesis". They disagree with Hakes and the autonomy hypothesis, instead arguing for the "interaction hypothesis", which is that "the child's acquisition of basic comprehension and production processes is influenced by the development of metalinguistic awareness, and conversely, metalinguistic development is influenced by linguistic development" (Smith & Tager-Flusberg, 1982/ p. 451).[1] Smith and Tager-Flusberg point out that detecting and correcting errors in speech production is an essential function of metalinguistic awareness, a function which is present from early childhood. Piaget also acknowledged that any intentional action (which must certainly include speaking) requires the actor to be aware of at least the goals and the success or failure of the action. Piaget (1976) called this "minimal consciousness". However, Smith and Tager-Flusberg seem to be suggesting that children have more than "minimal consciousness" of language from a very young age. They provide data which indicates that children as young as 5-years-old are able to pass modified metalinguistic awareness tasks. Furthermore, children's success on these tasks is correlated with performance on tests of language skills. Although these findings are not inexplicable by the Piagetian/Hakes model, they do suggest that the development of metalinguistic awareness is a gradual and continuous process rather than stage-like.

Bialystok (1986b; 1993; 1999) has also argued that metalinguistic awareness is continuous with language learning and use. Bialystok has theorized that developments in

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[11] This criticism is somewhat unjustified since Hakes (1980) does state that "it would be unreasonable to expect to find an age or cognitive developmental level below which children gave no evidence of metalinguistic abilities" (p. 39).

two related components of language processing, *analysis* (representation) and *control* (selective attention), are responsible for metalinguistic awareness. *Analysis* is defined as "the ability to represent increasingly explicit and abstract structures" (Bialystok, 1999, p.636) and *control* is "the ability to selectively attend to specific aspects of a representation" (Bialystok, 1999, p. 636). According to the "analysis and control" framework, developments in children's linguistic abilities (which includes metalinguistic problem solving) are due to incremental developments of analysis and control. Furthermore, Bialystok proposes that these two components are related: Increased analysis means that children's representations of language are more explicit and abstract, allowing them to engage in activities that require higher levels of control.

Much of Bialystok's research has focused on the development of control in children. She has shown, for example, that bilingual children are better than their monolingual counterparts on tasks (including non-verbal tasks) that require selective attention (Bialystok, 1988; Bialystok, 1999). No similar advantages of bilingualism have been found for the development of analysis. According to the analysis and control framework, *analysis* increase via qualitative changes in the way in which language is represented by children. Bialystok has proposed that there are at least three levels of language representation: *conceptual representation*, *formal representation*, and *symbolic representation*. With conceptual representations, children "encode the world of meaning" (Bialystok, 1993, p. 223) but do not represent the structure of language. Children's understanding of language at this level is procedurally based. At the next level, formal representation, children begin to represent the "explicit codings of language structure... including the units of language: word, sound, sentence" (Bialystok, 1993, p. 223).

Finally, with the development of symbolic representations, children are able to explicitly represent the ways in which the components of speech relate to one another; language is understood as a symbolic system. Bialystok (1992) has suggested that Karmiloff-Smith's (1986; 1992) Representational Redescription model of cognitive development may be the means by which children's representation of language passes through qualitative distinct levels of representation.

Karmiloff-Smith's theory on metalinguistic awareness is part of her Representational Redescription model of cognitive development, a model initially developed from research on language acquisition and metalinguistic awareness (viz., Karmiloff-Smith, 1979). According to Karmiloff-Smith's (1992) model, developmental change is a three phase process, during which children's knowledge passes through four levels of representation. This process occurs repeatedly within a domain (such as language) at the "micro-domain" level (e.g., pronoun use). Initially, children learn how to respond to a certain stimulus (or type of stimuli) and, in so doing, they acquire an encapsulated procedure that does not interact with prior representations. For example, children may have a procedure for using the word 'played' instead of 'play' and another for using 'went' instead of 'go'. In both cases, the procedure marks past tense, however, at this phase, children are not aware of this functional correspondence between the procedures; the children have linguistic knowledge, but not metalinguistic knowledge. The end of the first phase is marked by consistently successful performance, which Karmiloff-Smith has labeled *behavioral mastery*.

During the next two phases, change is not brought about by external stimuli, but instead it occurs spontaneously through "system-internal dynamics". Procedural

representations, which were formed in the first phase, are recoded into more abstract formats, a process called *representational redescription*. Through representational redescription, knowledge that was implicitly contained in the procedural representations becomes explicit (Phase 2) and conscious (Phase 3) as it is recoded into more abstract representational formats.

During the second phase (when the knowledge is explicit, but unconscious), internal representations dominate over external, incoming data. This can lead to new behavioral errors where performance was previously successful. For example, children may over-generalize the rule for forming past-tense and say 'goed' even though they previously were able to use 'went' correctly. It is at this phase that children first begin to demonstrate metalinguistic awareness. Finally, in the third phase, internal representations and external data are reconciled. Children no longer make the errors typical of Phase 2; they have explicit and conscious knowledge and will succeed on standard metalinguistic awareness tasks.

To summarize the representational redescription model, children form procedural representations as they learn to speak a language. Once children have reached a certain competency (i.e., behavioral mastery) in a linguistic micro-domain (e.g., pronoun use), then their procedural representations within that micro-domain are then recoded into a more abstract format. The more abstract format allows knowledge that was implicit in the procedure to become explicitly represented. Finally, there is one more recoding into a

format that allows the explicit knowledge to be available for conscious access.[1] This process is repeated independently in all linguistic micro-domains.

Although there are significant differences between the theories reviewed above, there are also some important common features of the Piagetian and neo-Piagetian explanations of metalinguistic awareness. All of the theories suggest that children acquire cognitive flexibility and a more abstract and explicit understanding of language as their linguistic representations proceed through different levels. Another common claim is that developments in metalinguistic awareness require an increase in children's attentional control; children must be able to "distance" themselves from the use of language to attend to the form of language. Finally, there is a common assumption in these theories that children can abstract from speech the units of language which are used by the (literate) adults in their communities. These theories contend that all of the above abilities are acquired by children solely through normal cognitive development and/or language acquisition. However, many theorist have argued that at least some of these abilities are a part of the cognitive effects of literacy.

The Cognitive Effects of Literacy

The debate over the cognitive effects of literacy is almost as old as writing itself. In Plato's Phaedrus, for example, Socrates is critical of writing and considers it inferior to speech. Among Socrates' critiques is that writing will lead to a deterioration of memory because people will rely on text to remember things and therefore will not practice using their memory. Since Plato, however, most theorists have tended to regard literacy as being of benefit to cognition. In fact, in the recent past it was often asserted that literacy,

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[1] Karmiloff-Smith (1992) has suggested that there may be another recoding which is necessary before

in particular the invention of the alphabetic script, is an essential step in the "evolution" of societies. For example, Levi-Bruhl (1923) claimed that writing is essential for the "civilized" mind and Rousseau (1754-91/1966) suggested that the different ways of writing correspond to different "stages" in the way that people gathered into nations; "savages" depict objects, "barbarians" make signs for words and propositions, and finally, "civilized" people use an alphabet.

More recently, these "great divide" theories of literacy, which claim that literacy is essential for advanced cognition and subsequently label over half of humanity as inferior, have fallen out of favor. They have been criticized for being ethnocentric (e.g., Scribner & Cole, 1981) and "romantic" (Harris, 1989). These criticisms lead Scribner and Cole to suggest that literacy is simply a cultural tool that requires the use of certain (preexisting) cognitive skills; the effects of literacy are merely the result of practicing these mental skills. Increases in other, more general cognitive abilities, which have often been attributed to literacy (e.g., logical reasoning), are in fact the result of explicit training in schools: schooling trains children on the types of tasks used to assess these abilities (e.g., logical syllogisms). Although few contemporary theorists would suggest that literacy is necessary for having a "civilized" mind, it is still possible that the cognitive ramifications of writing are greater than simply allowing an opportunity to practice certain mental skills. This is particularly so in the realm of metalinguistic awareness.

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children have verbal access to their knowledge, but she equivocates on this point.

Literacy and Metalinguistic Awareness

Vygotsky (1986) was one of the first to argue that writing restructures the way in which we think about language. He focused on the differences between writing and speech, pointing out that they are fundamentally different activities: speech is "spontaneous, involuntary, and nonconscious" while writing is "abstract, voluntary, and conscious". According to Vygotsky, these differences are responsible for the cognitive effects of literacy, the foremost of which is bringing "awareness to speech" (p. 183). In Vygotsky's own words:

> Writing... requires deliberate analytical action on the part of the child. In speaking, he is hardly conscious of the sounds he pronounces and quite unconscious of the mental operations he performs. In writing, he must take cognizance of the sound structure of each word, dissect it, and reproduce it in alphabetical symbols, which he must have studied and memorized before (p. 182).

For Vygotsky, the advantage gained by writing -- and subsequently the difficulty for children in becoming metalinguistically aware -- is being able to think abstractly about language. The Piagetians (e.g., Piaget, Sinclair and Hakes) and the neo-Piagetians (e.g., Bialystok and Karmiloff-Smith) also claimed that abstract thinking was the stumbling block for children's being able to reflect on language. The theories differ only in what they propose is responsible for children's ability to engage in this form of abstract thought. The Piagetians explain this development as being caused by the advent of reflected abstraction, which is acquired with concrete operations. The neo-Piagetians claim that children's representations of language are recoded into more abstract formats which then allows conscious reflection on the properties of speech. Finally, Vygotsky

proposes that it is the abstractness of writing that is responsible for allowing children to take cognizance of language.

An assumption made by all of the above mentioned theories is that linguistic categories such as "words" and "phonemes" are either known implicitly by children before they become metalinguistically aware or else that they are observable by children once they have reached a sufficient level of competency with speech and are able to cognitively distance themselves from language. In other words, the theories assume that the linguistic categories used by literate adults in a culture are "real" and directly observable in speech. Harris (1980; 1997) has criticized linguists for using writing as a model of speech, a practice he calls "scriptism". According to Harris, writing presents an idealized form of language that does not concur with actual speech. Furthermore, he claims that linguistic categories such as phonemes and words are "second-order constructs, belonging not to nature but to culture" (Harris, 1997, p. 270). If a similar criticism is applied to our "folk theories" of language, then it would suggest that the way in which we think about language in a literate culture is determined by the "idealized" model provided by the writing system. It is possible, therefore, that having cognitive "distance" from language is necessary, but not sufficient for children to acquiring metalinguistic awareness: In order to think about language, children may also have to acquire the specific model of language that is used by their culture -- a model derived from the writing system.

The Model Theory of Literacy

The claim that a culture's writing system provides the model used to reflect on language has been made by Roy Harris, from a historical perspective and by David

Olson, from a psychological perspective. For example, Harris (1989) has argued that the inventors of the Greek alphabet were not aware of the phonemic qualities of the Greek language (as has often been claimed). Instead, he suggests that when the Greeks borrowed the Phoenician alphabet of consonants, they found that it could not be used unless some letters were added for vowels. It was through this process of adapting the Phoenician script, of trying to relate the Phoenician letters to Greek, that the Greeks became aware of the phonemic qualities of their own language. In other words, the Greeks did not develop an alphabetic script because of a preexisting phonemic awareness, but instead, phonemic awareness came about *because* the Greeks had an alphabetic system in which phonemes were represented.

In his *model* theory of literacy, Olson (1994) concurs with many of the points made by Harris (1989). There are two main claims made by the model theory. The first is that literacy, especially reading, provides a model for the way in which we interpret the world. To support this claim, Olson gives historical examples of how the early empiricists were influenced by theories of reading. They believed that the way in which we read a text is same way that we should read "the book of Nature": text is available for all to read, but meaning must be interpreted from the text, and "facts" can be observed by all, but "causes" must be inferred from the facts.

The second claim (which is more directly related to the current thesis) is that writing provides a model for understanding the structure of language; we become aware of the particular aspects of speech which are represented or codified by our culture's script (Olson, 1994). Olson argues that writing is responsible for bringing aspects of language into consciousness by providing the set of categories that is used to reflect on

and analyze speech. Which aspects of language are brought into consciousness is dependent on the nature of the writing system -- different writing systems will bring different aspects of speech into consciousness. For example, the advent of writing systems which represented verbal form rather than meaning, allowed for the differentiation between what is said and what is meant; what is said are the words written on the paper while what is meant is how those words are to be taken. With the development of each script, language is thought of in terms of the units of writing that are used in that script. With syllabic scripts like Vai, for example, the syllable becomes an object of thought and with alphabetic scripts like Greek or English, phoneme-like sound units (corresponding to letters) become available for conscious reflection. Although Olson focuses primarily on cultural and historical implications of the model theory, he does suggest that children undergo a similar process. He claims that for children, "learning to read is learning to hear speech in a new way" (Olson, 1994, p. 85).

One way in which Harris and Olson differ is in their view of the ontological status of the linguistic units. For Harris, writing is actually *creating* the linguistic categories; they are not "real" or "natural kinds". For Olson (1994), on the other hand, what writing does is "provide the categories needed for introspecting the *implicit structures of language* [italics added]" (p. 77); writing brings "*aspects of spoken language* [italics added] into consciousness" (p. 258). In other words, these are real properties of speech, known implicitly by any speaker. However, regardless of whether the linguistic categories are "theoretical idealizations" or "implicit properties", both Harris and Olson agree that writing provides a model used to reflect on speech.

Although the claims made by the Piagetian and neo-Piagetian theories (such as Karmiloff-Smith's *representational redescription* theory) and by the *model* theory (Olson, 1994) seem incompatible, it may be possible to reconcile their apparently conflicting claims: that metalinguistic awareness is a part of language acquisition and that it is a product of learning to read and write. This can be done by conceptualizing metalinguistic awareness as a constellation of skills rather than a single ability. It is possible, therefore, that cognitive developments and language acquisition as well as literacy play essential, yet unique, roles. This proposed view of metalinguistic awareness has been developed into a *multi-factor* model which will be presented shortly. First, however, what is meant by literacy must be clarified. Central to the proposed model is an understanding of literacy that goes beyond simply being able to read and write proper text. It will be argued that children learn about writing well before they are formally taught and are functionally literate, and that children's conception of language is shaped through this early, informal acquisition of literacy.

Children's Acquisition of Literacy

Several researchers have found that young, pre-reading children's scores on certain metalinguistic tasks (usually assessments of phonemic awareness) predict subsequent performance on standardized literacy tasks (e.g., Bradley & Bryant, 1983; Kirtley et al., 1989). The conclusion that is made from these findings is that before children can learn to read and write, they must be aware of certain properties of speech. A problem with this conclusion, however, is that the research has used a very narrow definition of literacy; these studies have tended to measure children's "level of literacy" by the number of words they can read from a standardized list. In contrast, there is a

growing movement to view literacy as an emergent process that begins well before formal instruction, and to view children as acquiring some aspects of literacy before they are actually able to read (e.g., Clay, 1991; Owen, 1995; Teale, 1986).

This approach to literacy acquisition has been most extensively developed by Emilia Ferreiro and her colleges (e.g., Ferreiro, 1985; Ferreiro, 1994; Ferreiro, 1996; Ferreiro & Teberosky, 1982). Ferreiro takes a Piagetian stance in explaining how children become literate. According to Ferreiro, writing is a "cultural object" that children actively attempt to understand. Children are faced with a mass of "chaotic data" and to make sense of it, they form "theories" (or in Piagetian terms, "assimilatory schemes") which they use to understand the written world. As the children construct their theories about literacy, they transform and eventually reconstruct it.

Much of Ferreiro's work can be considered as an attempt to answer the question, "What does writing represent for children?" Instead of considering young, preliterate children's attempts at reading and writing as simply being wrong, Ferreiro considers them to be indicative of the children's conceptions of writing. This has allowed her to identify commonalties in the process that children go through in becoming literate which Ferreiro has categorized into specific "levels of literacy".

According to Ferreiro, the first step that children must make is to identify the criteria for differentiating writing from other forms of graphical representation (e.g., drawing). This is done not by focusing on the forms of the elements of writing, but by identifying how the forms are arranged (i.e., in linear order). Typically, children achieve this sometime around the age of four.

Pre-syllabic Level

Once children can distinguish writing from other graphic marks, they begin the task of trying to identify the elements necessary to interpret writing. Ferreiro has found that children develop two "theories" about what constitutes good writing: *The Minimum Quantity Hypothesis* which is that a piece of writing needs at least 2 or 3 letters and *The Hypothesis of Intra-Relational Qualitative Variation* which is roughly that the letters in a piece of writing must not all be the same. For these children, the components of writing are not interpretable, it is only the totality that has meaning. The children's understanding of what writing represents is *pre-syllabic*. At this level, writing is not matched to the linguistic form of speech and in fact, children will often differentiate between what is written and what can be read. For example, if shown a picture of three ducks and asked to write "ducks", children will often make three marks. When asked to "read" each mark individually, the children will say "duck", "duck", "duck", however, when asked what they say all together, they will answer "ducks"!

Syllabic Level

By the time children are five, they are making comparisons between different pieces of writing and are attempting to explain the similarities and differences between them. Before this, children will use any letters in writing, but now they start to realize that certain letters are used for certain words and that the number of letters used is not arbitrary. Children at this level try to understand what is being segmented. Because meaning can not be segmented, they look to the signifier; they look to the sequence of articulated sounds as the only candidate for segmentation. This is the beginning of the *phonetization* period in which children try to match "pieces of sound" to pieces of text

(i.e., letters). This leads children to form the *Syllabic Hypothesis* which is that letters represent syllables. This, however, leads to conflicts with the Minimum Quantity and Intra-Relational Qualitative Variation hypotheses when children attempt to write monosyllabic words.

Syllabic - Alphabetic & Alphabetic Levels

By the time most children are six, these conflicts have gradually lead them towards matching phonemes to letters. At first, children will try to retain the syllabic hypothesis with the addition of some phonemic representation. However, once children begin to incorporate the alphabetic principle, they quickly progress to the stage in which they are using letters to represent phonemes. Children will initially place all of the emphasis on the alphabetic principle and will often ignore other aspects of the writing system (e.g., spaces between words). Eventually, however, and with much variation between children, all of the aspects of the writing system are adopted.

Ferreiro's work has been primarily with Spanish-speaking children and the exact process and stages may differ for English-speaking children.[1] The exact levels are not essential to the current thesis, what is important is that children as young as four have begun the process of becoming literate and that through this process, the children "discover" properties of speech (i.e., letter - phoneme correspondence). These findings support the claim that writing affects children's conception of language, a claim that is developed further in the proposed model of metalinguistic awareness presented in the following section.

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[1] Vernon (1993) has found that, with some minor variation, English-speaking children do conform to the stages described by Ferreiro. However, Kamii and her colleagues (Kamii, Long, Manning & Manning,

Chapter 2: Proposed Model and Hypotheses

A "Multi-factor" Model of Metalinguistic Awareness

The theories reviewed above have argued that it is only one or two factors that are responsible for children's acquisition of metalinguistic awareness: for Hakes, general cognitive development is essential, for Smith and Tager-Flusberg, metalinguistic awareness is concurrent with language acquisition, for Bialystok, metalinguistic awareness depends on increases in cognitive control and analysis, and for Olson, literacy is essential. Although each theory focuses on a different factor, it may be possible to reconcile these apparently conflicting claims by conceiving of metalinguistic awareness not as a single skill, but instead as a constellation of skills that are acquired at different times and to different degrees throughout childhood. Each of the previously mentioned factors, that is, language acquisition, cognitive control, and literacy, uniquely contributes to metalinguistic awareness. This proposed *multi-factor model* of metalinguistic awareness is outlined below.

In the early stages of language acquisition, children learn to associate words with specific items and events. Nelson and Lucariello (1985) have proposed that at this stage of language learning, children are using language referentially, but not symbolically. It is not until the end of the second year, when children use language to represent objects and events that are not immediate present and attempt to communicate this representation to other people, that language has become a symbolic system (Nelson, 1996). Until this development, children's metalinguistic understanding is limited to what Piaget (1976)

1990) found more substantial differences between young Spanish- and English-speaking children's early understanding of literacy.

referred to as "minimal consciousness": Children have an awareness of only the objectives and outcome of their linguistic behaviors.

Understanding language as a symbolic system enables children to become aware of language in new ways. This linguistic development allows children to compare immediate linguistic stimuli (e.g., identifying which of three words "sounds the same"), and also allows the children to engage in new forms of language play (e.g., rhyming). Children at this level also understand metalinguistic concepts such as "say" and "tell". However, it is not until children acquire the cognitive capacity to deal with multiple representations of the same stimuli, which is the same skill that is behind children's ability to grasp the "appearance/reality" distinction, that they are able to reflect on both the meaning and form of speech. With this cognitive development, children are able to form implicit representations of some metalinguistic units, such as morphemes and syllables, that reflect "natural" features of language. Throughout early childhood, there is an increase in children's cognitive control (which develops with other "executive functions") that results in increased ability to reflect on and manipulate language.

The next important development for metalinguistic awareness is the acquisition of literacy. Children must acquire the linguistic model that is used by their culture to represent language; they must acquire the set of conventional categories (e.g., words and letters/phonemes) into which the steady stream of speech can be sorted. In literate cultures, the writing system provides a model of the categories which are used to segment speech and children come to understand language in terms of the categories which are represented or "codified" by writing (Olson, 1994). Literacy serves two purposes: it brings into consciousness children's implicit conceptions of "natural" linguistic units

(this is Olson's thesis) and it also presents children with a "theoretical idealization" that includes linguistic categories such as "phoneme" and "word" that are projected onto speech.

In this proposed model, the acquisition of metalinguistic awareness includes both gradual developments (e.g., increases in cognitive control and specific knowledge such as meanings) as well as specific developmental milestones that predict stages or levels of metalinguistic awareness. For example, in order for children to have anything other than minimal consciousness of language, their linguistic development must have reached the stage in which language is understood as a symbolic system. Also, before children are able to represent any aspect of the form of speech, they must be able to hold in mind dual representations of a single object. Finally, literacy plays a crucial role in children becoming aware of the units of language that are used by their culture, by bringing implicit concepts into consciousness and by presenting second-order socially constructed linguistic concepts. These developmental milestones and their ramifications for metalinguistic awareness are presented in Table 1.

Table 1

Developmental Milestones in the Multi-Factor Model of Metalinguistic Awareness

Milestone	Age	Nature of Metalinguistic Awareness
Language - Simple association between words & objects/events.	0-2 years	- "Minimal consciousness": Aware of goals & success/failure of linguistic behaviors
- Language becomes a representational medium	2-3 years	- Able to compare immediate linguistic stimuli and "play" with language. - Can understand metalinguistic terms such as "say" and "tell" (but not "say/mean" distinction).
Cognition - Can hold multiple representations of same object.	3-4 years	- Able to attend to both meaning and (to limited extent) form of speech. - Begins to form some implicit language concepts (?)
Literacy - Learns writing system; script provides a model of language.	5+ years	- Through process of relating writing to spoken language, implicit concepts brought into consciousness & second-order socially constructed linguistic units learned.

Design and Hypotheses

The goal of the current dissertation is to examine the role of literacy in children's acquisition of metalinguistic awareness. Literacy is the last, and arguably the most controversial of the milestones in the multi-factor model of metalinguistic awareness. The claim that was investigated is that writing provides a model for reflecting on language. According to this thesis, as children learn their culture's writing system, they are also

learning how to talk and think about language. Therefore, children's acquisition of certain metalinguistic concepts should be mediated by their current understanding of their culture's script. It has been suggested above that the role of literacy is both to bring into consciousness existing implicit concepts and to present socially constructed concepts (which may not be "natural" linguistic units). Differentiating between these two functions is beyond the scope of the current dissertation (although this issue will be visited again in the general discussion). The thesis of the current dissertation is simply that literacy is essential for children to become aware of certain metalinguistic concepts, a claim that is in direct contrast with theories proposing that awareness of language comes about solely as a consequence of learning to speak or through more general cognitive developments (with literacy having little or no effect).

Two studies are presented that investigate the literacy hypothesis. The first study examines children's understanding of the concept of "word" in speech and text. In accordance with the literacy hypothesis, it was predicted that children understand "word" as a unit of written language at the same time or before they understand it as a unit of speech, even though they have considerably more experience with spoken language. The concept of word was the focus of this study for three reasons: there has been considerable research on developmental differences in children's understanding of this metalinguistic concept; there is historical evidence which suggests that the development of the concept of word may have been a product of writing; and finally, Karmiloff-Smith and her colleagues (Karmiloff-Smith et al., 1996) have recently presented evidence that children have an understanding of word at a much younger age than previously reported, leading these researchers to suggest that metalinguistic awareness could have little or nothing to

do with literacy. Children's understanding of word was tested using the "part on-line" task developed by Karmiloff-Smith and her colleagues while children's understanding of word as a unit of text was tested using a variation of tasks developed by Ferreiro and her colleagues (e.g., Ferreiro, 1994; Ferreiro & Teberosky, 1982). The empirical hypothesis of Study 1 was that children's performance on the text-based "word" tasks would predict performance on the speech-based task.

If children's understanding of language is mediated by their familiarity with writing, then differences in cultures' scripts should predict developmental differences in the acquisition of metalinguistic awareness. This prediction was the focus of the second study, in which differences between Chinese and Canadian children's understanding of the metalinguistic concepts of word and syllable/character in speech and text was investigated. Word was chosen because it is one of the most salient features of English writing and character was chosen because it is the most salient feature of Chinese writing. (Syllables were deemed to be the closest English equivalent to characters.) It was hypothesized that children would first show an awareness of whichever metalinguistic concept is most salient in their script (i.e., "words" for English and "characters" for Chinese children). Furthermore, it was hypothesized that in both languages, children's awareness of both linguistic concepts in speech would be mediated by their understanding of these concepts as units of text.

Chapter 3: Study 1

Introduction

Children's conception of word is one of the most commonly investigated areas of metalinguistic awareness, second only perhaps to phonemic awareness. Researchers have place a great emphasis on children's acquisition of this linguistic concept, suggesting, for example, that "the concept of 'word', ... is a seminal event in the development of metalinguistic thought..."[1] (Templeton, 1986, p. 294) and that words "are the primary meaning constituents of language" (Bialystok, 1993, p. 214). In spite of this emphasis, the nature of words has been the topic of much debate.

Scholes (1993), for example, draws on linguistic and historical data to argue that word is not a construct of speech. He agrees with the model theory of literacy (Olson, 1994) and suggests that "speakers acquire their concept of *word* by virtue of their acquisition and use of written language and, once this understanding is acquired, are then able to apply it to an analysis of spoken language" (p. 87). Similarly, Harris (1997) claims that "the word has no status as a universally recognized linguistic unit" (p. 269), instead suggesting that words are "second-order constructs belonging not to nature but to culture" (p. 270). In contrast, Miller (1994) has argued that all language users must have an implicit concept of word. According to Miller, words can be defined in several different ways (as morphemes, as the head of some phrases, as a phonological unit, etc.) and confusion about what a word is -- and subsequently, the notion that speakers could

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[1] Templeton (1986) continues by noting that the onset of a concept of word "follows upon an immersion in the multifaceted reality of print or visual language" (p. 294).

not have a concept of word -- comes about only when "one insists on a monolithic view [of word] from a single perspective" (Miller, 1994, p. 87).

Miller's multiple-meaning solution aside, just what a word is remains a matter of much controversy. Researchers, such as Anglin (1993), are forced to adopt a working definition of words as "different boldfaced main entry words found in the most recent, largest nonhistorical dictionary of English" (p. 177). That is, what a word is is determined by the specialized knowledge of lexicographers who are faced with the task of itemizing linguistic elements for a dictionary. Are *day* and *days* different words? Is *birthday* one word or two? And so on. *Word* appears to be an analytic abstraction suitable for itemizing the content of language. Furthermore, the very task of itemizing lexical elements is very much a matter of literacy, that is, of reflective analysis of properties of speech fostered and facilitated by the use of written records. Indeed, Scribner and Cole's (1981) non-literate subjects, as well as the Vai-literates lacked a concept of word. When Scribner and Cole asked their Vai literates to segment a piece of text, the Vai were not able to mark word boundaries; the smallest unit that they could divide text into was meaningful phrases.[1] Interviews were done with one expert Vai literate who explained that the text would not make sense if it were divided further. Presumably, the reason that the Vai did not understand the concept of word was because it is not a prominent feature of their writing system. Anthropologists, such as Goody and Finnegan have made similar observations (e.g., Finnegan, 1977; Goody, 1971).

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[1] The Vai do not have a lexical marker to denote "word", and so Scribner and Cole (1981) used the closest expression, "*koali kul**" which seemed to denote "word", "sentence", or "phrase" and was thought by Scribner and Cole to translate literally as "piece of speech" or "utterance".

Regardless of whether words are "natural kinds" known implicitly by all language users or "theoretical abstractions" only made conscious by literacy, "word" is a linguistic concept that children in our culture acquire. The next section will review existing research on children's acquisition of the concept of word.

Children's Acquisition of the Concept of Word

In his early work, Piaget (1929) examined children's concepts of one class of words, specifically, names. He claimed that children pass through distinct stages in understanding the nature of names. At an early stage, children take the name of a thing to be a part of, or essence of a thing. Later, children recognize the distinction between a sign (i.e., a name) and the object, but fail to recognized that names are social conventions -- they still feel that names are somehow essentially linked to the objects. Only at a still later age, about 11 or 12 years of age, do children recognize both the distinction from things and the conventional nature of names. Piaget argued that the development of children's understanding of names was related to more general cognitive developments. Specifically, he suggested that an understanding of names comes about as children solve three more general difficulties: confusion between sign and object, between the internal and the external, and between matter and thought.[1]

Piaget appears to have assumed that children's general knowledge of words could be derived from what they knew about names. In fact, names may have a quite different ontological status than other words. Macnamara (1982) found that children as young as 17 months could differentiate between common and proper names. For example, at 14-

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[1] Recent research suggests has found that even adults do not always indicate an understanding that names are social conventions; various social-discursive factors influence both children's and adults' answers (Homer, Brockmeier, Kamawar, & Olson, 1998).

months-old, Macnamara's son Kieran would refer to many different dogs as puppy but refused to accept that a new acquaintance could be called Lisa, which was the name of his cousin. Kieran seemed to believe that each name belonged to one and only one individual. Names are indeed property and in some cultures protected by copyright laws, whereas words are linguistic entities that serve as major constituents of speech. Their developmental histories may be quite different.

Other researchers have adapted the approach developed by Piaget and used it to investigate children's conception of all words, not just names. One of the first empirical investigations to examine children's concept of word was conducted by Downing and Oliver (1974). The experimenters presented children with a series of auditory stimuli, some of which were words and others of which were non-verbal sounds, phonemes, syllables, phrases or sentences. After each presentation, children were asked if the sound that they had just heard was a word. All of the children, who ranged in age from 4 to 8 years, overextended the use of *word*, however, the youngest group (4;5 to 5;5) did so significantly more then did the older children. More recently, Bialystok (1986a) investigated children's concept of word using a variety of Piagetian style tasks. For example, children were read a sentence and then asked to move a marker for each word in the sentence. In another task, children had to judge which of two spoken words was bigger: *train* or *caterpillar*. In both tasks, there was a significant improvement from JK to Grade 1. (For a summary of this work, see Birdsong, 1989.)

Papandropoulou and Sinclair (1974) also adopted a Piagetian stance to investigate children's conception of word. To assess children's understanding of the relationship between names and objects, the experimenters used a variety of tasks including asking

children to define "word" and asking them to say a "short", "long" or "difficult" word. In general, the younger children would often conflate physical properties of an object with linguistic properties of the word for the object: For example, one child claimed that *radio* was a difficult word because, "nobody explained it to me" (p. 244). The authors identified four distinct levels of understanding which ranged from children making no distinction between words and physical objects, to a fairly sophisticated metalinguistic understanding of *words* as autonomous, having meaning, and part of a linguistic system. One interesting observation reported by Papandropoulou (1978) is that a "large number" of the children between the ages of six and 12 referred to letters in response to the question, "What is a word?" This is despite the fact that all of the test questions about words were given orally. Papandropoulou speculated that writing, because of its "permanent and objective qualities", may be more readily studied than speech. However, the author still claimed that metalinguistic awareness is part of general cognitive development, that it is "one manifestation of the general structuring of knowledge that takes place during cognitive development" (p. 55).

The Role of Literacy

Vygotsky (1986) is usually credited with the hypothesis that developing an awareness of the properties of speech is a consequence of writing and literacy; claiming, for example, that "in writing, [a child] must take cognizance of the sound structure of each word, dissect it, and reproduce it in alphabetical symbols..." (p. 182). Vygotsky agrees with Piaget that "for a long time to a child the word is a property, rather than the symbol of an object" (p. 92). But Vygotsky, like Piaget, appears to have assumed that the problem is children's changing conception of word rather than the more fundamental

question of the acquisition of the very notion of word in the first place. Hence, he fails to note that children's earliest conception of what a word is may also be explained by appeal to learning the conventions of writing. Yet, it is a rather straightforward extrapolation from Vygotsky's theory to suggest that children's concepts of words, too, are products of experience with writing rather than a more direct introspective analysis of their own speech.

Indeed, there is now an abundance of research suggesting that some concepts about speech are derived from writing. Jesse Reid (1966) was the first to note that children learned to systematically apply the concept of word to written texts before they applied it to their own speech, suggesting that the concept of word was derived from writing. Since then, many researchers such as Ehri (1985), Francis (1975), Downing and Leong (1982), Bialystok (1986a), and Olson (1994) have shown that children's early metalinguistic concepts are influenced, if not determined by experience with writing -- a word is taken to be something to write or to read, often with little understanding of how what is read relates to their own speech.

As mentioned, Olson (1994) has theorized on the specifics of how literacy affects metalinguistic awareness in his *model theory* of literacy. Olson argues that writing provides a model for reflecting on some properties of speech -- it is responsible for bringing certain aspects of language into consciousness by providing the set of categories that is used to reflect on and analyze speech. Therefore, we become aware of the particular aspects of speech which are represented or codified by our culture's script. Which aspects of language are brought into consciousness is dependent on the nature of the writing system -- different writing systems will bring different aspects of speech into

consciousness. For example, with syllabic scripts, the syllable becomes an object of thought and with alphabetic scripts, phoneme-like sound units (corresponding to letters) become available for conscious thought.

As mentioned, Karmiloff-Smith (Karmiloff-Smith et al., 1996) has argued that metalinguistic awareness, specifically children's conception of word, may be solely a consequence of speaking a language and that literacy plays no role. Karmiloff-Smith and her colleagues studied children's knowledge of what counts as a word using a method that was more "on-line" than the usual metalinguistic judgment tasks. They read a story to children, stopping at various points to ask the children to "repeat the last word". With this task, even many four-year-old pre-readers succeeded after only a brief training whereas with other methods, such as moving a token for each word (e.g., Bialystok, 1986), it is only 6- or 7-year-olds that succeed. The authors explain this finding by referring to the Representational Redescription (RR) model of cognitive development (Karmiloff-Smith, 1992), suggesting that the 4- and 5-year-olds who can do the on-line task have an explicit, but unconscious concept of word. According to the RR model, this concept has come about due to "system-internal dynamics" which have recoded the procedural representations that were formed as children learned to speak. The authors conclude that "metalinguistic awareness could turn out to be a part of language acquisition itself rather than the mere product of literacy" (Karmiloff-Smith et al., 1996, p. 215). These findings appear to challenge the suggestion that literacy plays a role in children's conception of word. Indeed, Karmiloff-Smith's theory suggests that children should succeed on the on-line tasks years before and independently from their knowledge of the properties of scripts.

The *multi-factor model* of metalinguistic awareness presented above may provide a way of partially reconciling the apparently conflicting claims that understanding the concept of word is a part of language acquisition (as suggested by Karmiloff-Smith's RR model) and that a familiarity with written text is essential for becoming aware of this linguistic concept (as suggested by Olson's model theory). According to the proposed model, in order to reflect on the form of speech, children's language acquisition must have progressed at least to the point of language being used as a symbolic system and their cognitive development must have progressed to allow them to hold in mind multiple representations of a single object. In learning what a word is, however, children are both learning something about their own speech practices and also learning something about the conventions for analyzing speech in their particular literate, linguistic community. That is, children are not merely learning to reflect on speech, but also to think about their speech in terms of some historically evolved, conventional coding scheme, compatible with the structure of writing. In learning what a word is, children use the convention of writing as a model to introspect and categorize the properties of their own speech. This would suggest that the children in Karmiloff-Smith et al. (1994) who were able to identify words using the "on-line" task may have some understanding of the nature of writing, even if they were not fully literate.

Children's Early Literacy Understanding

What do preliterate children know about the nature of writing? Recently, several researchers have taken a constructivist stance towards children's acquisition of literacy. This approach has been led by Ferreiro who argues that children actively attempt to understand literacy by forming, testing and modifying "theories" about it (Ferreiro &

Teberosky, 1982). As the children construct their theories, they transform and eventually reconstruct the writing system. Preliterate children's errors are not merely wrong, but reflect their current "theory" of writing. These theories emerge well before formal literacy instruction, but are essential to learning to read and write. The work of Ferreiro indicates that most Spanish-speaking children have some understanding of the representational nature of writing by the age of four -- which is the age at which children were able to succeed on Karmiloff-Smith's "on-line" concept of word task. Homer and Olson (1999) have made similar observations using Ferreiro's technique with English-speaking children. The fact that children have begun the process of becoming literate by age four suggests that the children who succeeded on the on-line task of Karmiloff-Smith et al. (1994) were able to do so because they had an understanding of word as a piece of text. This would be consistent with the hypothesis that an understanding of written text mediates children's understanding of the concept of word.

Design and Hypothesis of Study 1

To test the hypothesis that literacy, broadly defined as exposure to written text, plays a mediating role in children's conception of word, pre- and early school-aged children were given a series of tasks to test their awareness of the concept of word in written text and in oral speech. The text-based tasks included the following: 1) Word Circle -- children were shown a picture under which was written a four or five word written sentence. The sentence was read by the experimenter who then asked the children to circle a specific word in the text. This task tested the children's understanding of the mapping of the temporal order of constituents in speech with the spatial ordering of constituents in writing. 2) Word Cover -- children were shown a piece of text, which was

read by the experimenter. The words were covered one at a time and the children were asked what the text then said. This task was expected to be the most difficult because it not only tested the children's understanding of temporal mapping, but also the one-to-one correspondence of words in text and speech. To determine if children could divide a stream of speech into words, they were given a task based on Karmiloff-Smith et al. (1996). Children were read a story during which the experimenter occasionally stopped and ask the child to repeat the last word. If Karmiloff-Smith is correct, then children should be able to succeed on the verbal task, even if they fail on the text-based task. On the other hand, if children's metalinguistic knowledge of words is derived from writing, then their performance on the oral and written tasks should be highly correlated. This is in spite of the fact that the children will have had much more experience with speech than with written text.

Method

Subjects

Subjects for this study were 36 English-speaking children from day-cares and after-school programs in middle-class neighborhoods in Toronto. The children ranged in age from 4;0 to 7;2 and were divided into four age groups. 4-year-olds (n = 10, range = 4;0 - 4;11, mean age = 4;5), 5-year-olds (n = 12, range = 5;0 - 5;11, mean age = 5;5), and 6-year-old (n = 14, range = 6;0 - 7;2, mean age = 6;6). There were approximately equal numbers of boys and girls in each age group.

Procedure

Children were given one speech based task and two text-based tasks that assessed their metalinguistic understanding of "word".[1] The order of the tasks was counter-balanced. (The protocols can be found in Appendix A.)

The speech-based task was based on Karmiloff-Smith et al. (1994) and consisted of three stages: pre-test, training and post-test. Thestages were as follows:

Word Repetition - Pretest. During the pretest, children were read one of two stories, during which the experimenter would periodically stop and ask the children, "What was the last word I said?" This was done with 10 open-class and closed-class words for a total score out of 20.

Word Repetition - Training. Immediately following the pre-test, children were given a training phase. For this, the experimenter would read a sentence to a child (e.g., "Big bird is yellow") and then ask her to say back the last word. Corrective feed-back was given to the child's responses. For example, if the child repeated the entire phrase, "Big Bird is yellow," then the experimenter might say: "Just say the last WORD. When I say, 'Big bird is yellow,' I want you to only say back the last word, 'yellow'." The training phase continued for 10 sentences or until the child correctly responded to two consecutive sentences.

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[1] The children also received another task were they were shown a brief piece of text, (e.g., "Bruce baked four cakes") and asked to count the number of words in the text. However, almost all of the children correctly answered the "word count" questions, (except for a few children who counted letters). The most likely explanation for this is that the words were visually distinct enough to be counted by even the youngest children, regardless of whether or not they had any concept of "word". It seems, therefore, that this task did not require a metalinguistic understanding of "word" and so it was not included in further analyses.

Word Repetition - Post-test. A post-test was then given which was identical in format to the pretest, except that the second story was used. Again, there were 10 open-class and 10 closed-class word, giving the child a total score out of 20 for each test.

The text-based tasks were as follows:

Word Cover. Children were shown and read a short piece of text, (e.g., "Three little pigs"). The words in the text were then covered up, one at a time and the child was asked, "What does this say now?" (This task is based on work by Ferreiro, reported in Ferreiro and Teverosky, 1982.) This procedure was repeated for one 3-word phrase and one 4-word phrase, with the order counter-balanced. Children received a score out of 5, one point for each time they correctly identified what the remaining uncovered words were.

Word Circle. Children were shown a picture with a sentence underneath; for example, a picture of an egg in a nest with the accompanying sentence, "The egg jumped." The experimenter read the sentence to the child and asked the child to "Circle where it says X," where X was one of the words in the sentence. (e.g., "Circle where it says, 'egg'.") The sentences were short (three to four words long) and the position of the word was counter-balanced (i.e., first, middle, and last). Children received a total score out of 12, with four words in each of the sentence positions.

Results

Developmental Differences

For each task, a one-way analysis of variance test was performed to examine the effect of age group. Post hoc analyses (Tukey-Honestly significant difference) were done to determine which age groups differed significantly. In each task, a significant age

effect was found. On the word-circle task, the 5- and 6-year-olds performed significantly better than did the 4-year-olds, $\underline{F}$ (2, 33) = 13.4, $p < .001$, $\underline{MSE}$ = 138.54. The oldest group differed from the youngest group on the word-cover task, $\underline{F}$ (2, 33) = 3.9, $p < .001$, $\underline{MSE}$ = 13.94. In the pre-training, word-repetition task, the oldest-group differed from the younger two groups, $\underline{F}$ (2, 33) = 7.6, $p < .005$, $\underline{MSE}$ = 270.41, and the same age differences were found in the post-training, word-repetition task with the 6-year-olds differing significantly from the younger two groups, $\underline{F}$ (2, 33) = 16.5, $p < .001$, $\underline{MSE}$ = 370.51. These results are summarized in Table 2.

Table 2

Age-Group Differences on Mean Score for Concept of Word Tasks

Task	4-year-olds (n=10)	5-year-olds (n=12)	6-year-olds (n=14)
Word Circle			
Total /12 (SD)	3.9* † (3.2)	8.0 (4.1)	10.8 (2.3)
Percent Correct	(33%)	(67%)	(90%)
Word Cover			
Total /5 (SD)	1.1* (1.4)	2.4 (1.9)	3.3 (2.1)
Percent Correct	(22%)	(48%)	(66%)
Word Repetition - Pre-training			
Total /20 (SD)	3.7* (4.4)	6.5* (6.5)	12.9 (6.4)
Percent Correct	(18%)	(33%)	(65%)
Word Repetition - Post-training			
Total /20 (SD)	5.2* (5.6)	9.6* (5.6)	16.2 (3.0)
Percent Correct	(26%)	(48%)	(81%)

* indicates significant difference from 6-year-olds, $p < .05$
† indicates significant difference from 5-year-olds, $p < .05$.

It is clear from Table 2 that all age-groups performed better on the word-repetition task after training. To determine the effects of training, a 2 x 3 ANOVA was conducted with Word Repetition scores (Pre- versus Post-Training) as a within-subject factor and Age Group (4, 5, or 6 years of age) as a between subjects factor. As would be expected from the previous analyses, there was a significant effect of Age Group, F (2,

33) = 12.35, p < .001, MSE = 51.44. There was also a significant main effect of Training, F (1, 33) = 18.88, p < .001, MSE = 6.56. However, the Training x Age interaction was not significant, F (2, 33) =.84, p > .43, MSE = 6.56, indicating that the training effect was the same for each age group.

Relation of Text- and Speech-based Tasks

Overall, children's performance on the speech-based and text-based tasks was highly correlated. (The correlation coefficients are reported Table 3.) Even controlling for age, the text-based and speech-based tasks were significantly correlated. Controlling for age, the Word Circle (*pr* (33)= .49, $p < .005$) and Word Cover (*pr* (33) = .71, $p < .001$) tasks were both significantly correlated with the pre-training task. Similarly, with age partialled out, the post-training task was significantly correlated with "Word Circle" (*pr* (33) = .48, $p < .005$) and "Word Cover" (*pr* (33) = .50, $p < .005$. In Figure 1, the percent correct for each task at the different age-levels is graphed and the close relation among the tasks is clearly illustrated.

Table 3

Correlations for Children's Age (in months) and Total Scores on each Task (n = 36)

	Age	Word-Circle	Word-Cover	Word-Repeat (Pre-training)
Age	--			
Word-Circle	.71	--		
Word-Cover	.51	.77	--	
Word-Repeat (Pre-training)	.62	.71	.80	--
Word-Repeat (Post-training)	.71	.73	.65	.86

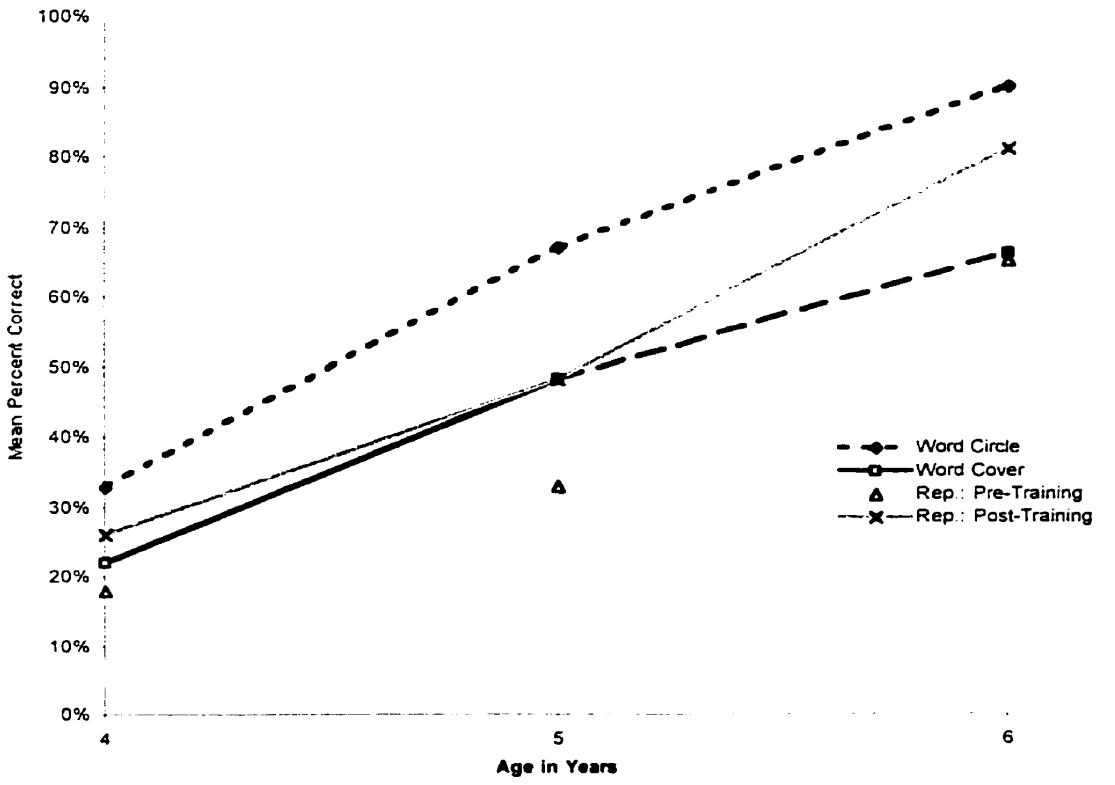

Figure 1. Mean percent correct by age group for each metalinguistic task.

To test the hypothesis that children's metalinguistic understanding of "word" in speech would depend on their awareness of "word" as a unit of text, performance on the speech-based word tasks (pre- and post-test scores) were regressed on age and performance on the text-based word tasks. A Total Literacy score was calculated by combining scores on the two text-based word tasks, Word Circle and Word Cover. Total Literacy and Age (in months) were entered as independent variables in two hierarchical regression equations; one with pre-training score on the word-repetition task as the dependent variable and one with post-training score as the dependent variable. Age was entered in the first block and then Total Literacy was entered into the equation to see if it made a unique contribution. The change in Multiple Correlation from Block 1 to Block 2 (i.e., $^{\Delta}\underline{R}^2$) indicates the unique contribution of literacy to children's awareness of word. (See Table 4.) For the pre-training task, the overall regression was significant, $\underline{R}^2 = .63$, $\underline{F} = 27.90$, $\underline{p} < .001$; the analysis further revealed that Total Literacy accounted for a unique 25% of the variance (i.e., for Block 2 the $^{\Delta}\underline{R}^2 = .25$). For the post-training score, the overall regression equation was again significant, $\underline{R}^2 = .63$, $\underline{F} = 28.30$, $\underline{p} < .001$; the analysis further revealed that Total Literacy accounted for a unique 12% of the variance (i.e., for Block 2 the $^{\Delta}\underline{R}^2 = .12$)

Table 4

Hierarchical Regression Analysis for Age and Literacy Predicting Speech-based Concept of Word Score (N = 36)

a) Prediction of Pre-Training Score

Variable	B	SE B	β	R^2 (adj)	F	$^{\Delta}R^2$	F($^{\Delta}R^2$)
Block 1 (df = 1)				.38 (.36)	20.93***	-	-
Age (in months)	.39	.08	.62***				
Block 2 (df = 2)				.63 (.61)	27.91***	.25	21.97**
Age (in months)	.10	.09	.15 (n.s.)				*
Total Literacy	.80	.17	.68***				

b) Prediction of Post-Training

Variable	B	SE B	β	R^2 (adj)	F	$^{\Delta}R^2$	F($^{\Delta}R^2$)
Block 1 (df = 1)				.51 (.49)	34.98***	-	-
Age (in months)	.41	.07	.71***				
Block (df = 2)				.63 (.61)	28.30**	.12	11.17**
Age (in months)	.22	.08	.38*				
Total Literacy	.53	.16	.48**				

Note. * = p < .05; ** = p < .01; ** = p <.001

Discussion

As predicted, children's overall performance on the speech-based and text-based tasks was related. Scores on the oral, Word Repetition task correlated significantly with scores on both the Word Circle and Word Cover text-based tasks. Such correlations, of course, do not specify the direction of causality; they fail to indicate whether the oral metalinguistic knowledge is a prerequisite for or a consequence of written metalinguistic knowledge of words. It says only that they are significantly associated to each other. A parallel puzzle currently exists regarding phonological awareness (Ehri, 1985).

However, if we combine the findings of this study with the earlier observations of such anthropological writers as Scribner and Cole (1983) and Finnegan (1977) who reported that the traditional cultures they studied had no concept of word as a lexical entity, it seems fair to conclude that writing is a causal factor in acquiring a concept of word. On the other hand, the effectiveness of the limited training given to children on the Word Repetition task, that is of learning to pick out the last word from the continuous stream of speech, indicates that at least a limited awareness of words can be taught via purely oral means. Nonetheless, if word awareness in oral language is independent of literacy, then there is no reason why it should be related to word awareness in written text. The latter should just be a consequence of learning to read. The finding that the two are closely related must count as evidence that writing plays a role in oral word awareness.

The findings of Study 1 are consistent with the *multi-factor model* of metalinguistic awareness. According to this proposed model, a certain level of linguistic competency is essential, but not sufficient for children to reflect on the form of language.

Children must explicitly learn their culture's "folk theory" of language, especially the linguistic units that are used to divide up the continuous stream of speech (e.g., "words"). In literate cultures, children learn this model by using the writing system as a model for spoken language. The correlations of the text- and speech-based tasks suggest that a concept of word develops in the course of relating writing to speech; the concept is developed as children discover how written signs carve up the more continuous structures of speech.

To further specify the precise relation between reading and oral metalinguistic knowledge, it is necessary to study learners who are learning to read scripts which are less conspicuously word based than modern English writing. This is the purpose of Study 2. A second study was conducted in which the role of script on children's understanding of metalinguistic concepts was investigated with both English-speaking children in Canada and with Mandarin-speaking children in China. It was hypothesized that qualitative differences between the cultures' scripts would lead to analogous differences in children's development of metalinguistic awareness.

Chapter 4: Study 2

Introduction

The results from Study 1 suggest that, as predicted by the multi-factor model, an understanding of text plays a significant role in children's acquisition of metalinguistic awareness. More specifically, the findings support the claim that writing provides a model of the categories that are used to reflect on speech (Olson, 1994). If children's understanding of language is mediated by knowledge of their culture's script, then children from cultures whose writing systems represent different aspects of language should demonstrate corresponding differences in their development of metalinguistic awareness. For example, learning an alphabetic script should bring about an awareness of phoneme-like properties of language (corresponding to letters) while learning a syllabic script should bring about an awareness of syllables.

A second study was undertaken to test the hypothesis that qualitative differences between cultures' scripts will lead to analogous differences in children's acquisition of metalinguistic awareness. The role of script on children's understanding of metalinguistic concepts was investigated with English-speaking children in Canada and with Mandarin-speaking children in China. The same tasks were used with both groups and, except for language, the stimuli were kept as identical as possible. Before describing the study, however, it will be useful to give some details about the nature of the Chinese writing system, to describe literacy acquisition in China, and to review the literature on metalinguistic awareness in Chinese speakers.

The Chinese Writing System

The writing system current used in China is descended from the oldest known Chinese script which arose during the Shang dynasty, during the last quarter of the second millennium BC (Boltz, 1996). The basic unit of the Chinese writing system is the character. It is currently estimated that there are approximately 60 000 characters in Chinese, and this number keeps growing. In spite of the large number, becoming functionally literate usually requires a knowledge of only 2 400 characters, and a recent statistical analysis indicates that 3 800 characters account for 99.9% of the characters used in popular reading material (Mair, 1996).

There is some disagreement over how best to describe the Chinese writing system, more specifically, what exactly it is that characters represent. Some linguists suggest that the Chinese writing system should be thought of as an enormously large, but phonetically inexact syllabary, in which each character represents a syllable that also happens to convey some semantic information (e.g., DeFrancis, 1984). On the other hand, it has also been argued that Chinese is in fact a logographic script, in which each character represents a word (e.g., Sampson, 1985). Neither view is exactly correct: Characters represent morphemes, or "minimal meaningful units". In Chinese, however, each morpheme is only one syllable in length and is also a word. Morphemes and syllables are therefore co-extensive. However, although all characters (i.e., morpheme-syllables) are words, most Chinese words consist of two or more characters (Shu & Anderson, 1999). In the current thesis the term "syllable" will be used to refer to English syllables and Chinese syllable-morpheme-characters in speech and "character" will be

used to referring to text or when referring exclusively to Chinese syllables-morphemes. (In Chinese, the term "character" -- /zì/ -- refers to both the written and spoken form.)

A majority of Chinese characters can be broken down into constituent parts. Only about 18% of characters have evolved directly from ancient pictographs (Shu & Anderson, 1999) with the remaining 82% consisting of compound characters made up of two or more other characters combined into one new character, that represents a single morpheme-syllable. In general, there are two types of compound characters: one is a compound ideographs, in which each character conveys meaning (for example, the character for "tree" is repeated twice in the character for "woods"); the other, which accounts for the majority of compound characters, involves one character, the "radical", which conveys information about meaning, and another, the "phonetic", which conveys information about pronunciation. Neither the phonetic nor the radical convey their information exactly, and so readers must either guess or have memorized the character and its proper pronunciation (Mair, 1996).

Although the Chinese writing system is complex, there is an underlying logic to it (that goes much deeper than covered in this brief review). There is evidence that in the process of becoming literate, Chinese children acquire and use this logic (Shu & Anderson, 1999). Nonetheless, learning thousands of characters is still a formidable task. In the next section, we will review the process by which Chinese children learn to read and write.

Literacy Acquisition in China

Children in China begin school when they are 5- or 6-years-old, usually after attending kindergarten. Literacy instruction begins as soon as children enter primary

school. Several techniques have been developed to help children learn the thousands of characters needed to become functionally literate. In the "concentrated method", for example, children are taught characters in clusters of 7 to 12 which have been grouped together based on related shape, sound and/or meaning (Jiange & Li, 1985). Another approach that is becoming widely adopted is the use of an alphabetic (i.e., phonetic) script, such as Pinyin, during the early stages of literacy acquisition. Children learn Pinyin during the first 10 weeks of Grade 1, after which it is used to facilitate the learning of characters (Shu & Anderson, 1999). Insup Taylor (Taylor & Taylor, 1995) describes a lesson from a Chinese primary workbook in which children are shown the Pinyin spelling of a morpheme-syllable, a two morpheme-syllable word (written in Pinyin) that incorporates the morpheme-syllable being studied, the morpheme-syllable written in character form, the pictographic origin of the morpheme-syllable, and a picture of the object the character represents. (See Figure 2.) The use of Pinyin allows children to learn about 2 000 characters after two years of instruction and dramatically improves children's reading competence (Jiange & Li, 1985).

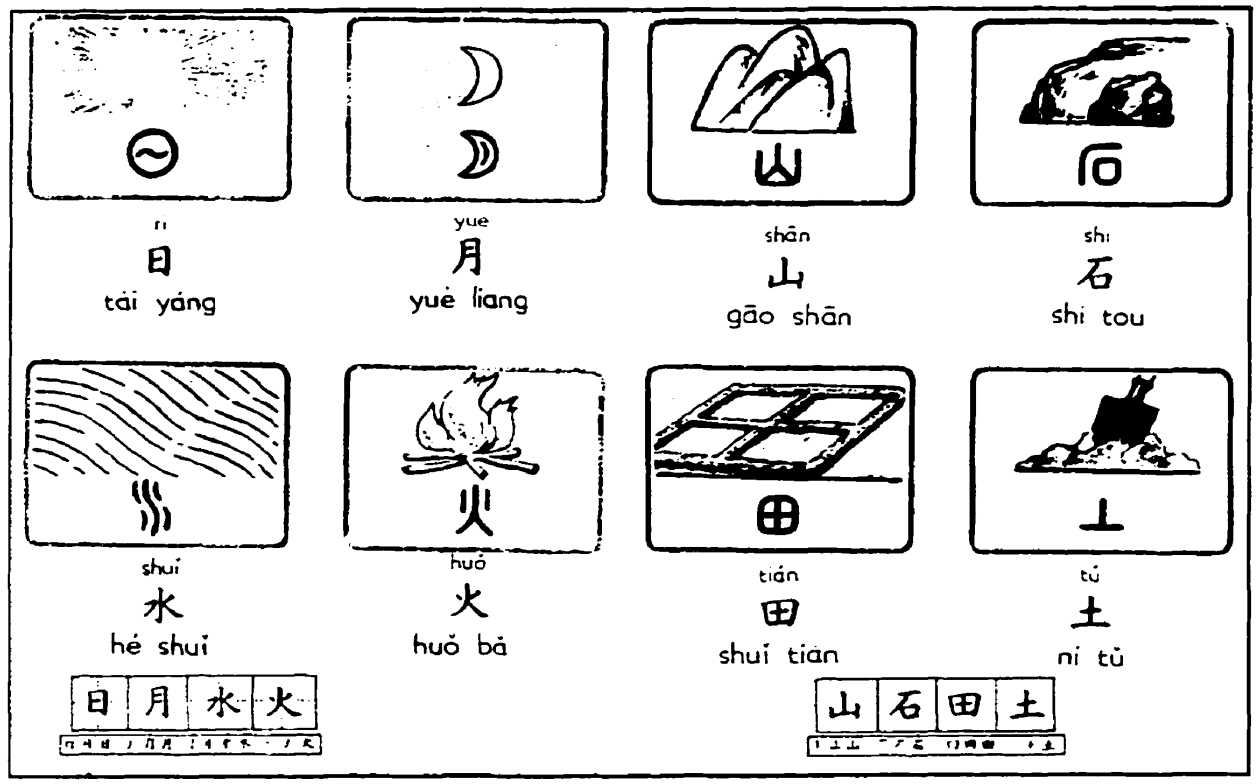

Figure 2. Page from a lesson book (Lessons 5 and 6 of "Recognizing Hanzi" pages 32-33 from volume I-1, People's Educational Publications, 1989).[1]

Research on children learning an alphabetic script (reviewed in the General Introduction) indicates that they have different conceptions about the nature of writing before they are actually able to read and write. For example, in the initial stages of literacy, children do not know that letters represent phonemes (Ferreiro & Teberosky, 1982) and may not even understand that writing represents language, instead thinking that it represents the world directly (Homer & Olson, 1999). In contrast, there has been very little research on Chinese children's early conception of writing. The predominate view of how children learn to read and write Chinese is that they simply memorize characters. For example, Fan, Tong, and Song (1987) write that "to read Chinese one

must first learn the characters... [which] children have to memorize mechanically" (p. 87). Fan et al. do claim that once children reach a certain level of literacy, they can then analyze the forms of character which facilitates the learning of new characters. For the young child, however, literacy acquisition is simply a matter of "mechanical memorization". Because of this view, 6 years is the youngest age group studied by most research on Chinese literacy acquisition.

One exception to this is a study by Marilyn Chi (1988) in which writing in 3- to 6-year-old Chinese-speaking children was examined. Chi found that young Chinese-speaking children's conceptions of the nature of writing developed through a series of stages including scribbling, pictographic writing, and invented writing with distinguishable qualities. Other studies that have investigated Chinese literacy acquisition have tended to focus on the relation between metalinguistic awareness and reading, particularly the relation between phonemic awareness and learning Pinyin (or other alphabetic Chinese script). This literature will be reviewed in the following section on metalinguistic awareness.

Metalinguistic Awareness in Chinese Speakers

Ho and Bryant (1997) have argued that Chinese children, like their English-speaking counterparts, are first aware of larger and then progressively smaller phonological segments of speech. Ho and Bryant suggest that Chinese children as young as 3-years-old are able to make general sound comparisons (e.g., identify partial homophones), but are not are able to detect rhymes until around 4 or 5 years of age and not able to detect onsets until 7 years of age. The authors conclude that "both the oral and

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[1] From Writing and Literacy in Chinese, Korean, and Japanese, by I. Taylor & M. Taylor, 1995,

writing systems of a language have obvious impacts on children's development of phonological awareness" (p. 124).

In general, the research on English-speaking children's phonological awareness has investigated children's abilities to segment words into smaller phonological units. In contrast, the research with Chinese children has tended to use syllables as the linguistic unit that children segment. Most researchers seem to assume that Chinese children develop an awareness of syllables as a product of speaking the language. Sampson (1985) points out that in Chinese, syllables are clearly distinguishable from one another whereas with English, although it may be easy to count the number of syllables in a word (e.g., "river" has two), there is often not a clear demarcation between the syllables (i.e., is the /v/ part of the first or second syllable?). This feature of Chinese suggests that it should be easier for children learning to speak this language to become aware of syllables than it is for English-speaking children. However, even English-speaking children seem to have some awareness of syllables from an early age.

In one of the first studies to examine children's awareness of syllables, Liberman and her colleagues (Liberman, Shankweiler, Fischer, & Carter, 1974) asked English-speaking children to "tap out" the number of syllables in a spoken word. The authors found that nearly half of the preschool and kindergarten children they tested could reach a criterion of six correct in a row and almost all of the grade one children tested reached this criterion. In a related study, Treiman and Zukowski (1991) presented preschool, kindergarten, and first-grade children with a series of word pairs and asked them to compare the two words to decide if they had any sound in common. Half of the word-

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pairs shared a common syllable, which was emphasized when the words were spoken to the children. The authors found that even preschoolers were able to reach a criterion of six consecutive correct answers on this task.

Although these and similar studies (e.g., Fox & Routh, 1975; Leong & Haines, 1978) indicate that children have some awareness of syllables from a young age, it is a rather implicit understanding. As argued in the General Introduction above and as Treiman and Zukowski (1991) themselves point out, "linguistic awareness is a continuum, not an all-or-none phenomena" (p. 67). The authors note that "performance on phonological awareness tasks varies with the cognitive demands of the task and the linguistic level that it taps" (p. 67-68). According to the multi-factor model of metalinguistic awareness, even though children may have an implicit understanding of some linguistic concepts, such as syllables, in order for children to become explicitly aware of these linguistic units they must be presented with a model for reflecting on speech. According to Olson (1994), it is literacy that provides this model.

There is already evidence that literacy does play a causal role in some Chinese-speaking children's metalinguistic awareness. More specifically, there is research to suggest that phonemic awareness in Chinese speakers is greatly affected by their learning an alphabetic script. In a groundbreaking study, Read, Zhang, Nie, and Ding (1986) asked Chinese adults to add and delete consonants in spoken Chinese words. (An English example of this sort of tasks is saying "fish" without the "/f/".) Some of the subjects had previously learned Pinyin, while others had only ever been taught to read and write characters. Read et al. found that only the subjects with prior exposure to the alphabetic script, Pinyin could segment words into phonemes. This effect was found even if

exposure to the script had occurred many years previous and the subjects could no longer read or write Pinyin. Huang and Hanley (1997) found similar effects in a longitudinal study that investigated phonemic awareness in Chinese-speaking children who, in addition to learning characters, were taught an alphabetic script. Chinese-speaking children in grade one were given a series of tasks that tested for phonemic awareness: once at the beginning of the school year; once 10 weeks later, after having been taught an alphabetic script; and again at the end of the school year, after having been taught to read and write Chinese characters. Huang and Hanley found that there was a significant increase in phonological awareness after the children had learned the alphabetic script, but there was not a significant increase between Time 2 (after learning the alphabetic script) and Time 3 (at the end of the school year, after learning characters). These findings led the authors to conclude that to some extent, phonemic awareness depends on learning an alphabetic script.

The goal of Study 2 is to determine if learning characters has an analogous effect on Chinese children's awareness of syllables. In English writing, syllables are not explicitly represented in the script (although writing may be a useful tool for teaching children to think about their speech in terms of syllables). With Chinese writing, however, characters represent syllables and are the most salient feature of the script. Therefore, according to the multi-factor model, Chinese children should become conscious of syllables at an earlier age than their English-speaking counterparts. Conversely, English-speaking children should demonstrate an earlier understanding of words than their Chinese counterparts. In part, the predicted differences could also be accounted for by differences in the structures of the two languages. For example,

syllables are more clearly distinguished in Chinese speech than they are in English speech. However, if characters are providing a model for Chinese children to reflect on speech, then their awareness of syllables in speech should be mediated by their awareness of characters in text, in the same way that an understanding of "word" as a unit of text predicted awareness of "word" as a unit of speech in the English-speaking children in Study 1.

Design and Hypotheses of Study 2

According to the multi-factor model of metalinguistic awareness, to become explicitly aware of certain metalinguistic concepts, children must be presented with a model for reflecting on speech. In literate cultures, writing provides this model; children become aware of the linguistic units that are represented in their culture's scripts (Olson, 1994). Therefore, children from cultures with radically different scripts should demonstrate corresponding differences in their acquisition of metalinguistic awareness.

The current study examined metalinguistic awareness in English-speaking Canadian and Mandarin-speaking Chinese children. The metalinguistic concepts that were investigated are: *Word*, because words are the most salient features of English writing, and *Syllable/Character*, because the most salient feature of Chinese writing is characters and syllables are the closest English equivalent. The general hypothesis is that children's understanding of the metalinguistic concepts of word and syllable/character will be predicted by their awareness of these concepts for representing pieces of text. Therefore, the children should first become aware of the linguistic categories that are represented by their culture's script: Canadian children will first be aware of words and Chinese children will first be aware of syllables. Although language is a confounding

variable in the cross-cultural comparison, some control will be exercised by comparing one and two character words. Additionally, if a further analysis indicates that the children's understanding of the linguistic terms as pieces of speech is predicted by their awareness of text (i.e., written words and character), then this would provide converging evidence for the script-as-model component of the multi-factor model of metalinguistic awareness. Furthermore, if the writing system is providing children with a model for reflecting on speech, then literacy effects should only be found for the concepts that are represented the culture's script (i.e., Words for English-speaking children and Characters for Chinese children).

To test the above hypotheses, children from Canada and China were given four sets of metalinguistic awareness tasks that differed on two variables: linguistic unit ("word" or "syllable/character") and medium (speech or text). The tasks were similar to those used in Study 1 (except that for half of the tasks, "syllable/character" was the target, not word). There were two speech-based tasks: 1) *Word/Syllable Repeat - List* in which children were read a brief sentence and asked to repeat the last word or "sound". ("Sound" was used to refer to syllables.) This task served as a training task and so corrective feedback was given. 2) *Word/Syllable Repeat - Story* which was identical to the Word Repetition task in Study 1. Children were read a story by the experimenter who stopped occasionally and asked the child to repeat the last word or syllable/character. The text-based tasks were the same as in Study 1) *Word/Syllable Cover* in which children were shown and read a brief piece of text. The text was then covered one word/syllable at a time and the children were asked what the text now said. 2) *Word/Syllable Circle* in

which children were shown and read a series of brief sentences, one at a time. The children were then asked to circle one specific word/syllable in the sentence.

The wording was as similar as possible for both the English and Chinese versions of the tasks, however, some modifications had to be made to accommodate cultural and linguistic differences.[1] For example, a sentence in one of the Canadian tasks mentioned "Mickey Mouse" while the same sentence in the Chinese task mentioned a character from a Chinese children's story. Also, words which are compound or polysyllabic in English are not necessarily multi-character words in Chinese and similarly, words which consist of two or more characters in Chinese may be only one syllable in English. For example, "cake" in Chinese consists of two characters.

In addition, the effects of literacy education can be partially differentiated from the effects of age. This is because Chinese parents have the choice of starting their children in Grade 1 at either age 5 or age 6. This decision is usually based on pragmatic social factors, and not on how cognitively advanced the child is at 5 years of age. For example, a mother may chose to wait until her son is six before enrolling him in school if her neighbor's child is 4-years-old and will be starting school the following year (thus allowing the families to share transportation responsibilities). This means that half of the 5-years-olds and have received one year of literacy education, which begins in grade 1. In addition, half of the 6-year-olds will have received one year of literacy training and half will have received two years. It is hypothesized that those children who have received more formal literacy instruction will have more awareness of linguistic concepts, and that

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[1] The Chinese portion of this study done in collaboration of Dr. Xu Fen of Hangzhou University.

this awareness will depend on the children's understanding of these concepts as aspects of writing and not chronological age.

Method

Subjects

The participants in this study were English-speaking children from Toronto, Canada (n = 41) and Mandarin-speaking children from Hangzhou, China (n = 122), who were recruited from schools and daycares. The children were divided into three age groups: 4-year-olds (Canadian children: n = 21, age range = 4;0 - 4;10, M = 4;6; Chinese children: n = 20, age range = 4;2 - 4;10, M = 4;6); 5-year-olds (Canadian children: n = 10, age range = 5;2 - 5;11, M = 5;7; Chinese children: n = 42, age range = 5;0 - 5;11, M = 5;6); and 6-year-olds (Canadian children: n = 10, age range = 6;2 - 8;1, M = 7;2; Chinese children: n = 60, age range = 6;0 - 7;11, M = 6;10). There were two groups of 5-year-old Chinese children: one that was still in daycare and had received no formal instruction in writing (n = 20) and another that had begun Grade 1 and had received some form of literacy instruction (n = 22). There were also two groups of 6-year-old Chinese children: one that had received 1 year of literacy instruction (n = 20) and one that had received two years of literacy instruction (n = 40).

Procedure

The Canadian and Chinese children were given a series of metalinguistic tasks, administered in their own language. The Chinese data collection was carried out by a Chinese experimenter. The tasks in the two languages were designed to be as identically worded as possible, however, some minor variations were required to accommodate cultural and linguistic differences. The tasks were administered to each child in two

sessions, which occurred on different days. The time between sessions varied from three to 14 days. Each session assessed a different metalinguistic concept: one session tested for understanding of word, and the other tested for an understanding of syllable/character. In both sessions, there were tasks that assessed understanding of the linguistic concepts in both text and in speech. The order of the sessions was counterbalanced. To control for the effects of task order, two lists of task-order were randomly generated (with the condition that Word/Syllable Repeat-List always preceded Word/Syllable Repeat-Story) and then two more lists were created by reversing the order of the sessions (e.g., syllable - word switched to word - syllable). This created four lists of task order. (The protocols and Task-Order Lists can be found in Appendix B.)

The text-based tasks for assessing understanding of word were as follows:

Word Cover - first language. This task was similar to the word cover task in Study 1. The task was done with two 3-word pieces of text: "Three pretty deer" and "Four dirty mice". For the first, the number mentioned in the phrase matches the number of words and in the other, it matches the number of syllables/characters. (The sentence in Chinese contained multi-character words.) The order of the phrases was counter-balanced. The text was read, then one word was covered (e.g., "[redacted] pretty deer") and the children were asked, "What does this say now?" The second word was then covered up and children were asked the question again. Children received a total score out of 4, one score for each time they correctly identified the remaining uncovered words.

Word Cover - foreign language. Children were given the same task again, this time using the other culture's script. The procedure was the same as above, except that

the foreign writing was "read" in the children's own language. Again, children received a total score out of 4, however, this task was not used in the final analyses.

Word Circle. Children were shown a series of brief sentences (three to six words or four to eight characters in length). The experimenter would read the sentences, one at a time, moving a finger in a continuous motion beneath the text. Children were then asked to circle one of the words in the text. The word was always in the middle of the sentence but the type of word (i.e., noun, verb, and functor) and number of syllables/characters in the word (one and two or more) were counter-balanced. For example, children were shown and read, "The garden is pretty" and then asked to circle where it says "garden". Children received two sentences with each combination of word type and syllable/character length for a total score out of 12.

The speech-based tasks for assessing "word" were as follows:

Word Repetition - List. Children were read a series of 8 brief sentences (three to five words in length). After each sentence, the children were asked to "say the last word". Both noun and verbs were used as target word and they varied in the number of syllables/characters they contained (one and two or more). (Because the target words were always the last word in the sentence, functors could not be used in this task.) For example, children were read the following sentence, "He is swimming," and asked to "say the last word". (The correct response would be "swimming".) Two sentences for each combination of word and syllable/character length was given for a total score of 8.

Word Repetition - Story. This task was similar to the Word Repetition task in Study one (based on Karmiloff-Smith et al, 1994). Children were told a story, during which the experimenter would occasionally stop and ask the children to "say the last

word I just said". Target words varied on type of word (i.e., noun, verb, and functor) and number of syllables/characters in the word (one and two or more) with the exception that only one syllable/character functors were used (because Chinese has very few multi-character functors). For example, the experimenter would read, "One day, a little girl..." and the child would have to respond "girl". Rather than having a separate training task (as in Study 1), children were given corrective feedback for the first 5 words. The rest of the story was then told with four of each combination of stimuli for a total score of 20.

In the other session, the same stimuli were used to assess understanding of syllable/character. For the speech-based tasks, the English children were asked to "say the last sound". To be scored correct, children did not have to respond with exactly the correct syllable, but they did have to respond with a word segment that came from the end of the last spoken word. (For example, if the phrase was, "The game is over", "ver" is the target syllable, but "/r/" would also be counted as correct.) The Chinese children were asked to "say the last character".

The speech-based task for assessing syllable/character were as follows:

Syllable/Character Repetition - List This task was identical to the word-repetition - list task, except that the target stimuli was the final syllable character. For example, children were read, "He is swimming," and the correct response was "ing". There were 8 items and so children received a total score of 8.

Syllable/Character Repetition - Story Again, except for the change in target stimuli, this task was the same as the Word Repetition task. For example, the experimenter would read, "Hood waved..." and the child would have to respond "/d/". The experimenter would stop at the same words in both the word and syllable/character

versions of this task and so the last words spoken varied in type (noun, verb, and function) and number of syllables/characters (1 or 2+). For training, children were given corrective feedback for the first 5 syllables/characters. The test consisted target stimuli from the remaining story, which gave a total score out of 20.

The text-based task for assessing syllable/character were as follows:

Syllable/Character Cover - first language. This task was the same as the word cover task, except that syllables/characters were covered instead of words. For example, after the second syllable was covered, the phrase "Three pretty deer" would appear as, "[redacted]y deer". The children received a total score out of 6 (because each phrase contained three syllables/characters).

Syllable/Character Cover - foreign language. This task was the same as the equivalent word cover task, except that syllables/characters were covered. This gave children a total score out of 6, however, this task was not included in the final analyses.

Syllable/Character Circle. This was the same as the word circle task, except that children were asked to circle a single syllable/character, instead of an entire word. For example, children were show and read, "The garden is pretty" and then asked to circle where it says "'den". Children received a total score out of 12.

Scoring

Four total scores were calculated for each child by summing the child's score on the tasks, grouped according to linguistic unit (word or syllable/character) and medium (speech or text). This generated the following summary variables: *Word - Speech* (Word Repetition - List + Word Repetition - Story); *Word - Text* (Word Circle + Word Cover); *Syllable/Character - Speech* (Syllable Repetition - Story + Syllable Repetition - List);

and *Syllable/Character - Text* (Syllable Circle + Syllable Cover). Because the four summary variable had different maximum totals, the sums were then converted to percentages in order to facilitate comparisons

Results

The results are reported in four sections. The first section reports the findings from a series of ANOVAs that were conducted to ensure that the non-experimental variables of sex and task-order did not affect performance. The second section examines overall effects of the experimental variables in a series of repeated measures ANOVAs. The third section focuses on the effects of literacy on children's awareness of word and syllable/character in speech. For this section, a number of regression equations were calculated for the Chinese and Canadian children separately. Finally, the fourth section reports on an analysis of the effects of age and literacy training on the Chinese children's metalinguistic awareness of character and syllable in speech.

Control Tests

To determine if there were any effects due to task order or sex, a series of ANOVAs were conducted for each of the four summary variables using List, Sex, Country and Age Group as the independent variables. Overall, there was no main effect of either sex or task order (i.e., task list) and none of the interactions with these factors were significant. (The tests are reported in Appendix C.) Because Task-order and Sex did not affect children's performance, they were not included in any further analyses.

Cross-Cultural Analyses

Table 5 contains children's mean percent correct on the metalinguistic awareness tasks broken down by Age Group, Country/Script, Medium, and Linguistic Concept. In

order to get a general impression of how these various factors affected performance on the metalinguistic awareness tasks, a repeated-measures ANOVA was conducted with Medium (speech vs. text) and Linguistic Concept (word vs. syllable/character) as within-subject variables and Age (4-, 5-, or 6-years-old) and Culture/Writing System (English-Canadian vs. Chinese) as between-subject factors. This created a 2 x 2 x 3 x 2 (Medium x Linguistic Concept x Age Group x Culture/Writing System) analysis, the results of which are reported in Table 6.

Table 5

Mean Percent Correct (sd) on Metalinguistic Awareness Tasks by Country, Linguistic Concept, Medium, and Age Group

			Age Group		
Country	Concept	Medium	4-years	5-years	6-years
China	Word	Text	25% (26)	57% (34)	92% (16)
		Speech	43% (19)	55% (15)	70% (12)
	Character	Text	31% (28)	62% (33)	94% (12)
		Speech	59% (27)	75% (26)	94% (11)
Canada	Word	Text	10% (22)	57% (39)	90% (29)
		Speech	16% (21)	53% (39)	81% (26)
	Syllable	Text	6% (12)	41% (44)	82% (32)
		Speech	8% (07)	30% (29)	60% (37)

Table 6

Repeated-Measures ANOVA for Metalinguistic Awareness (Age Group x Culture/Script x Linguistic Concept x Medium)

Source	df	F
Between Subjects		
Age Group (a)	2	90.54***
Culture/Script (s)	1	26.13***
a x s	2	2.89
s within-group error	157	(MS = .14)
Within Subjects		
Linguistic Concept (c)	1	.21
Medium (m)	1	.06
c x a	2	1.74
m x a	2	19.27***
c x s	1	98.27***
m x s	1	11.93**
c x a x s	2	3.63*
m x a x s	2	1.49
c x m	1	2.52
c x m x s	1	24.02***
c x m x a	2	.07
c x m x a x s	2	1.94
c + s within group error	157	(MS = .02)
m + s within group error	157	(MS = .03)
m + c + within group error	157	(MS = .02)

Note. *p < .05. **p < .01 ***p < .001

The analysis indicated that there was a significant main effect of Culture/Writing system. Collapsing across Medium and Age Group, the Chinese children had a significantly higher mean percent correct on the metalinguistic awareness tasks (M = 71%, sd = 24) than did the Canadian children (M = 35%, sd = 37). There was also a significant main effect for Age Group, with the 4-year-olds scoring lower on the metalinguistic awareness tasks (M = 24%, sd = 21) that than the 5-year-olds (M = 59%, sd = 26), who scored lower than the 6-year-olds (M = 86%, sd = 14). There was no main effect of either Linguistic Concept or Medium.

The analysis indicated several significant two-way interactions. The Culture/Writing System by Linguistic Concept interaction was significant. A simple effects analysis revealed that Linguistic Concept had a significant effect for both the Canadian children, F (1, 161) = 28.97, p < .001, and Chinese children, F (1, 161) = 106.90, p < .001. However, an examination of the means indicates that overall, the effects of concept was opposite for each group: As predicted, the Canadian children performed better on the "word" tasks (M = 41%, sd = 41) than on the "syllable" tasks (M = 30%, sd = 35), while the Chinese children performed better on the "character" tasks (M = 77%, sd = 27) than on the "word" tasks (M = 65%, sd = 24).

There was also a significant Age x Medium interaction. Simple effects analysis revealed that there was an effect of medium for the 4-year-olds, F (1, 160) = 19.00, p < .001, and the 6-year-olds, F (1, 160) = 24.78, p < .001, but not for the 5-year-olds, F (1, 160) = .88, p > .34. Examining the mean scores indicates that the 4-year-olds performed better on the speech-based tasks (M = 31%, sd = 25) than the text-based tasks (M = 18%,

sd = 24). In contrast, the 6-year-olds performed better on the text-based tasks (M = 92%, sd = 17) than the speech-based tasks (M = 80%, sd = 14).

A significant Culture/Writing System x Medium interaction was also found in the original Repeated Measures ANOVA. However, a subsequent analysis of simple effects did not indicate a significant effect of medium for either the Chinese children, F (1, 161) = .01, p > .90, or for the Canadian children, F (1, 161) = 1.32, p > .25.

Two of the higher-order interactions were found to be significant. The first was the 3-way interaction of Culture/Writing System x Concept x Medium. Simple effects analysis indicated that there was a significant Medium x Concept interaction for the Chinese children, F (1, 161) = 61.67, p < .001, but not for the Canadian children, F (1, 161) = 3.14, p > .07. Examining the mean scores for the Chinese children indicates that for "Word" the children performed better on the text-based tasks (M = 69%, sd = 35) than on the speech-based tasks (M = 60%, sd = 17). In contrast, for "Character" the Chinese children performed better on the speech-based tasks (M = 82%, sd = 24) than on the text-based tasks (M = 73%, sd = 33).

The second significant higher order-interaction was a Culture/Writing System x Age x Linguistic Concept 3-way interaction. Analysis of simple effects indicated that in both Culture/Writing systems for each age-group, there was a significant effect of Linguistic Concept: for the Canadian 4-year-olds, F (1, 157) = 4.01, p < .05; for the Canadian 5-year-olds, F (1, 157) = 21.87, p < .001; for the Canadian 6-year-olds, F (1, 157) = 12.11, p < .001; for the Chinese 4-year-olds, F (1, 157) = 12.54, p < .001; for the Chinese 5-year-olds, F (1, 157) = 38.74, p < .001; and for the Chinese 6-year-olds, F (1, 157) = 59.43, p < .001. As can be seen in Figure 3a and 3b, however, performance on the

two linguistic concepts was reversed for the two cultures: The Canadian children perform better on the "Word" tasks and the Chinese children perform better on the "Character" tasks.

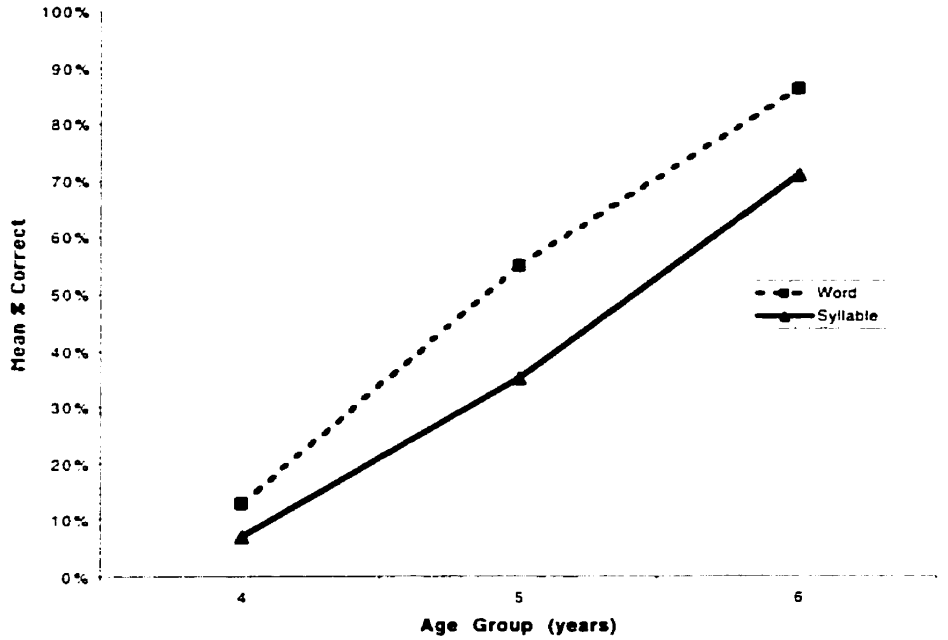

Figure 3a. Metalinguistic Awareness by Concept by Age for Canadian Children

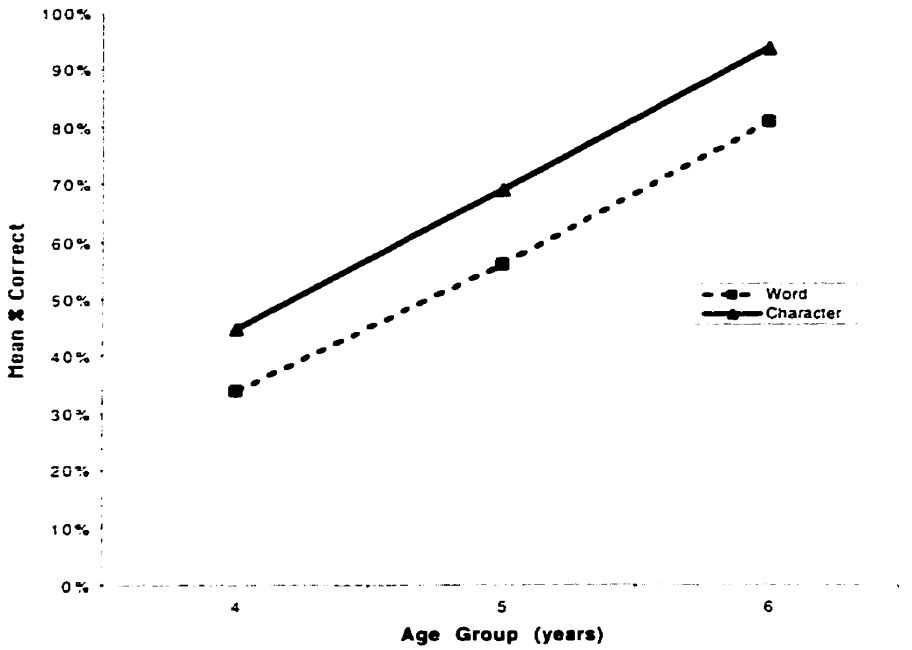

Figure 3b. Metalinguistic Awareness by Concept by Age for Chinese Children

The results of the above analyses are more-or-less consistent with what was predicted by the multi-factor model of metalinguistic awareness. However, there is a problem with the measure used above: A child could receive a score of 50% on the tests of one linguistic concept, even if they were using the other concept to answer the questions. This is because half of the stimuli were both words and characters/syllables. For example, when the Chinese children were asked to "say the last word" for one character words, the correct answer is both the last word and the last character, and therefore, even if a child always responds with the last "character", her answer would be correct for half of the "word" questions. A more precise comparison of the two linguistic concepts is achieved by using only target stimuli from words that have two or more characters/syllables; only then are the last word and character/syllable different. New totals for Word - Text, Word - Speech, Character/Syllable - Text, and Character/Syllable - Speech were calculated using only the contrastive stimuli (i.e., target stimuli from

words with two or more characters/syllables). These new totals were used in the subsequent analyses reported below.

Table 7 contains children's mean percent correct on the metalinguistic awareness tasks (for target stimuli from words with two or more characters/syllables) broken down by Age Group, Country/Script, Medium, and Linguistic Concept. To further analyze these data, a repeated-measures ANOVA was conducted with Medium (speech vs. text) and Linguistic Unit (word vs. syllable/character) as within-subject variables and Age (4-, 5-, or 6-years-old) and Culture/Writing System (English-Canadian vs. Chinese) as between-subject factors. This created a 2 x 2 x 3 x 2 (Medium x Linguistic Unit x Age Group x Culture/Writing System) analysis, the results of which are reported in Table 8.

Table 7

Mean Percent Correct (sd) on Metalinguistic Awareness Tasks (Contrastive Stimuli only) by Country, Linguistic Concept, Medium, and Age Group

			Age Group		
Country	Concept	Medium	4-years	5-years	6-years
China	Word	Text	21% (31)	48% (40)	89% (22)
		Speech	29% (17)	44% (32)	71% (26)
	Character	Text	24% (29)	63% (37)	88% (21)
		Speech	44% (33)	63% (35)	92% (16)
Canada	Word	Text	14% (26)	63% (41)	93% (24)
		Speech	15% (23)	48% (38)	77% (29)
	Syllable	Text	1% (5)	45% (50)	80% (42)
		Speech	5% (9)	21% (14)	31% (8)

Table 8

Repeated-Measures ANOVA for Metalinguistic Awareness - Contrastive Stimuli only (Age Group x Culture/Script x Linguistic Concept x Medium)

Source	df	F
	Between Subjects	
Age Group (a)	2	74.13***
Culture/Script (s)	1	14.62***
a x s	2	.57
s within-group error	157	(MS = .17)
	Within Subjects	
Linguistic Concept (c)	1	5.39*
Medium (m)	1	11.76**
c x a	2	1.72
m x a	2	15.63***
c x s	1	68.01***
m x s	1	18.29**
c x a x s	2	2.63
m x a x s	2	.91
c x m	1	.00
c x m x s	1	9.61**
c x m x a	2	.98
c x m x a x s	2	2.81
c + s within group error	157	(MS = .04)
m + s within group error	157	(MS = .05)
m + c + within group error	157	(MS = .05)

Note. *p < .05. **p < .01 ***p < .001

The repeated measures ANOVA revealed a significant main effect of Culture/Writing system: Chinese children had a significantly higher mean percent correct (M = 65%, sd = 29) than the Canadian children (M = 32%, sd = 34). There was also a significant main effect for Age Group, with the 4-year-olds having a lower mean percent correct on the metalinguistic awareness tasks (M = 19%; sd = 18) than the 5-year-olds (M = 53%, sd = 29), who had a mean percent correct that was lower than the 6-year-olds (M = 83%, sd = 16). The main effects of both within-subject variables were also significant, however, the actual differences were small. Collapsing across Age-Group and Culture/Writing System, children's mean percent correct for Character/Syllable (M = 59%, sd = 37) was greater than the mean percent correct for Word (M = 55%, sd = 34). Similarly, the average score for the Text-based tasks (M = 59%, sd = 39) was greater than the average for score for the Speech-based tasks (M = 51%, sd = 34).

Several of the two-way interactions were also significant. There was a significant Culture/Script x Concept interaction. Simple effects analysis revealed that there was an effect of Concept for both the Canadian children, F (1, 161) = 32.25, p < .001, and for the Chinese children, F (1, 161) = 40.33, p < .001. However, an examination of the means indicates that whereas the Canadian children scored higher on the Word tasks (M = 42%, sd = 40) than on the Syllable tasks (M = 23%, sd = 29), the Chinese children scored higher on the Character tasks (M = 71%, sd = 31) than on the Word tasks (M = 60%, sd = 31).

There was also a significant Age x Medium interaction. Simple effects analysis indicated that there was an effect of medium for the 4-year-olds, F (1, 160) = 4.91, p < .05, and the 6-year-olds, F (1, 160) = 14.11, p < .001), but not for the 5-year-olds, F (1,

160) = 2.7, $p > .10$. Although the 4-year-olds performed better on the speech-based tasks (M = 23%, sd = 21) than on the text-based tasks (M = 15%, sd = 22), the 6-year-olds performed better on the text-based tasks (M = 88%, sd = 20) than on the speech-based tasks (M = 72%, sd = 26).

There was also a significant Culture/Writing System x Medium interaction. Simple effects analysis indicated that the Canadian children performed better on the text-based tasks (M = 38%, sd = 43) than on the speech-based tasks (M = 27%, sd = 26), F (1, 161) = 9.45, $p < .005$, whereas there was no effect of medium for the Chinese children, F (1, 161) = .60, $p > .44$.

The only higher-order interaction that was significant was the 3-way interaction of Culture/Writing System x Concept x Medium. Simple effects analysis indicated that there was a significant Medium x Concept interaction for the Chinese children, F (1,161) = 12.51, $p < .001$, but not for the Canadian children, F (1, 161) = 1.73, $p > .19$. For the concept of Word, the Chinese children performed better on the text-based tasks (M = 64%, sd = 40) than on the speech-based tasks (M = 55%, sd = 33). In contrast, for the concept of Character, the Chinese children performed better on the speech-based tasks (M = 74%, sd = 32) than on the text-based tasks (M = 69%, sd = 36).

One possible concern with the cross-cultural comparisons in the above analyses is that half of the Chinese children began their literacy instruction at age 5 and half at age 6 -- the same age that Canadian children begin their formal literacy instruction (i.e., in Grade 1). It is possible that some of the cross-cultural differences found above may be due to improved performance on the metalinguistic awareness tasks by the Chinese children who have had additional literacy instruction. Therefore, another set of analyses

were conducted, excluding the Chinese children who had received early literacy training. (The effects of literacy education on the Chinese children's metalinguistic awareness is examined in detail below.) The mean percent correct on the metalinguistic awareness tasks for the contrastive stimuli (i.e., target stimuli from words with two or more characters/syllables) broken down by Age Group, Country/Script, Medium, and Linguistic Concept are presented in Table 9.

Table 9

Mean Percent Correct (sd) on Metalinguistic Awareness Tasks (Contrastive Stimuli only) by Country, Linguistic Concept, Medium, and Age Group (Late Educated Chinese Children only)

			Age Group		
Country	Concept	Medium	4-years	5-years	6-years
China	Word	Text	21% (31)	43% (41)	83% (28)
(n = 60)		Speech	29% (17)	38% (29)	56% (24)
	Character	Text	24% (29)	49% (37)	83% (26)
		Speech	44% (33)	52% (36)	91% (15)
Canada	Word	Text	14% (26)	63% (41)	93% (24)
(n = 41)		Speech	15% (23)	48% (38)	77% (29)
	Syllable	Text	01% (05)	45% (50)	80% (42)
		Speech	05% (09)	21% (14)	31% (08)

A 2 x 2 x 3 x 2 (Medium x Linguistic Concept x Age Group x Culture/Writing System) repeated measures ANOVA was conducted, the results of which are reported in Table 10. There was a significant main effect of Culture/Writing system: The Chinese children had a significantly higher mean percent correct (M = 51%, sd = 29) than the Canadian children (M = 32%, sd = 34). There was also a significant main effect for Age

Group, with the 4-year-olds having a lower mean percent correct on the metalinguistic awareness tasks (M = 19%; sd = 18) than the 5-year-olds (M = 45%, sd = 29), who had a mean percent correct that was lower than the 6-year-olds (M = 75%, sd = 18).

Although the actual differences were small, there were significant main effects of both within-subject variables. There was a significant effect of Linguistic Concept: Collapsing across Age-Group and Culture/Writing System, children's mean percent correct for Word (M = 44%, sd = 33) was greater than their mean percent correct for Character/Syllable (M = 43%, sd = 36). Similarly, there was a small, but significant main effect for Medium: The average score for the Text-based tasks (M = 45%, sd = 40) was greater than the average for score for the Speech-based tasks (M = 42%, sd = 28).

Table 10

Repeated-Measures ANOVA for Metalinguistic Awareness (Contrastive Stimuli) -- Excluding Chinese Children with Early Literacy Training (Age Group x Culture/Script x Linguistic Concept x Medium)

Source	df	F
	Between Subjects	
Age Group (a)	2	53.63***
Culture/Script (s)	1	4.97*
a x s	2	1.83
s within-group error	95	(MS = .18)
	Within Subjects	
Linguistic Concept (c)	1	4.32*
Medium (m)	1	10.69**
c x a	2	.56
m x a	2	15.18***
c x s	1	59.44***
m x s	1	15.77**
c x a x s	2	3.31
m x a x s	2	.61
c x m	1	.27
c x m x s	1	11.40**
c x m x a	2	..35
c x m x a x s	2	3.68*
c + s within group error	95	(MS = .04)
m + s within group error	95	(MS = .05)
m + c + within group error	95	(MS = .05)

Note. *p < .05. **p < .01 ***p < .001

As can be seen in Table 10, several of the two-way interactions were found to be significant. There was a significant Culture/Script x Concept interaction. Simple effects analysis revealed that there was an effect of Concept for both the Canadian children, F (1, 99) = 32.49, $p < .001$, and for the Chinese children, F (1, 99) = 20.30, $p < .001$. However, an examination of the means indicates that whereas the Canadian children scored higher on the Word tasks (M = 42%, sd = 40) than on the Syllable tasks (M = 23%, sd = 29), the Chinese children performed better on the Character tasks (M = 57%, sd = 34) than on the Word tasks (M = 45%, sd = 28).

The Age x Medium interaction was also significant. Simple effects analysis indicated that there was an effect of medium for the 4-year-olds, F (1, 98) = 4.97, $p < .05$, and the 6-year-olds, F (1, 98) = 15.66, $p < .001$), but not for the 5-year-olds, F (1, 98) = 2.61, $p > .10$. Although the 4-year-olds performed better on the speech-based tasks (M = 23%, sd = 21) than on the text-based tasks (M = 15%, sd = 22), the 6-year-olds performed better on the text-based tasks (M = 84%, sd = 24) than on the speech-based tasks (M = 67%, sd = 18).

There was also a significant Culture/Writing System x Medium interaction. Simple effects analysis indicated that although there was a significant effect of medium for the Canadian children, F (1, 99) = 9.08, $p < .005$, there was no effect of medium for the Chinese children, F (1, 99) = .26, $p > .61$. Overall, the Canadian children performed better on the text-based tasks (M = 38%, sd = 43) than on the speech-based tasks (M = 27%, sd = 26).

Two of the 3-way interactions were also found to be significant. There was a significant Culture/Writing System x Concept x Medium interaction. Simple effects

analysis indicated that there was a significant Medium x Concept interaction for the Chinese children, F (1,99) = 9.64, $p < .005$, but not for the Canadian children, F (1, 99) = 1.61, $p > .20$. For the concept of Word, the Chinese children performed better on the text-based tasks (M = 49%, sd = 41) than on the speech-based tasks (M = 41%, sd = 26). In contrast, for the concept of Character, the Chinese children performed better on the speech-based tasks (M = 63%, sd = 36) than on the text-based tasks (M = 52%, sd = 39).

The other significant 3-way interaction was Culture/Writing System x Age x Concept. Simple effects analysis indicated that there was a significant effect of Concept for all of the children with the exception of the 4-year-old Chinese children. The F values for the between-subject groups are as follows: for the Chinese 4-year-olds, F (1, 95) = 3.63, $p > .05$; for the Chinese 5-year-olds, F (1, 95) = 4.94, $p < .05$; and for the Chinese 6-year-olds, F (1, 95) = 14.52, $p < .001$; for the Canadian 4-year-olds, F (1, 95) = 6.82, $p < .05$; for the Canadian 5-year-olds, F (1, 95) = 12.00, $p < .005$; and for the Canadian 6-year-olds, F (1, 95) = 20.17, $p < .001$. As can be seen in Figure 4a and 4b, however, performance on the two linguistic concepts was reversed for the two cultures: The Canadian children perform better on the "Word" tasks and the Chinese children perform better on the "Character" tasks.

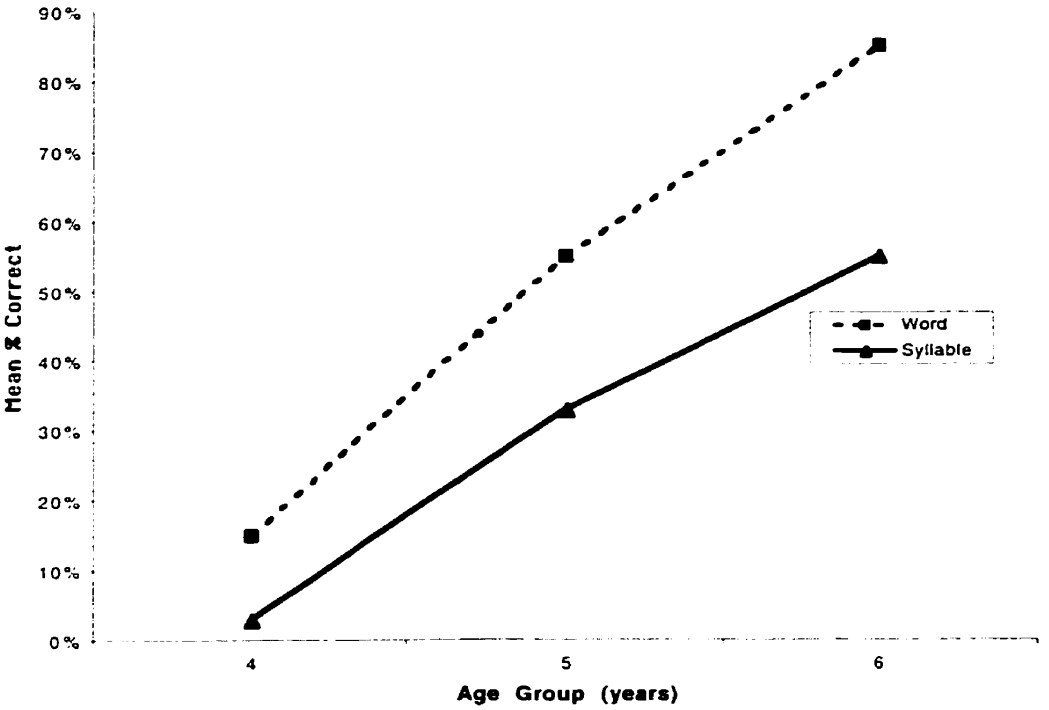

Figure 4a. Metalinguistic Awareness by Concept by Age for Canadian Children (Contrastive Stimuli)

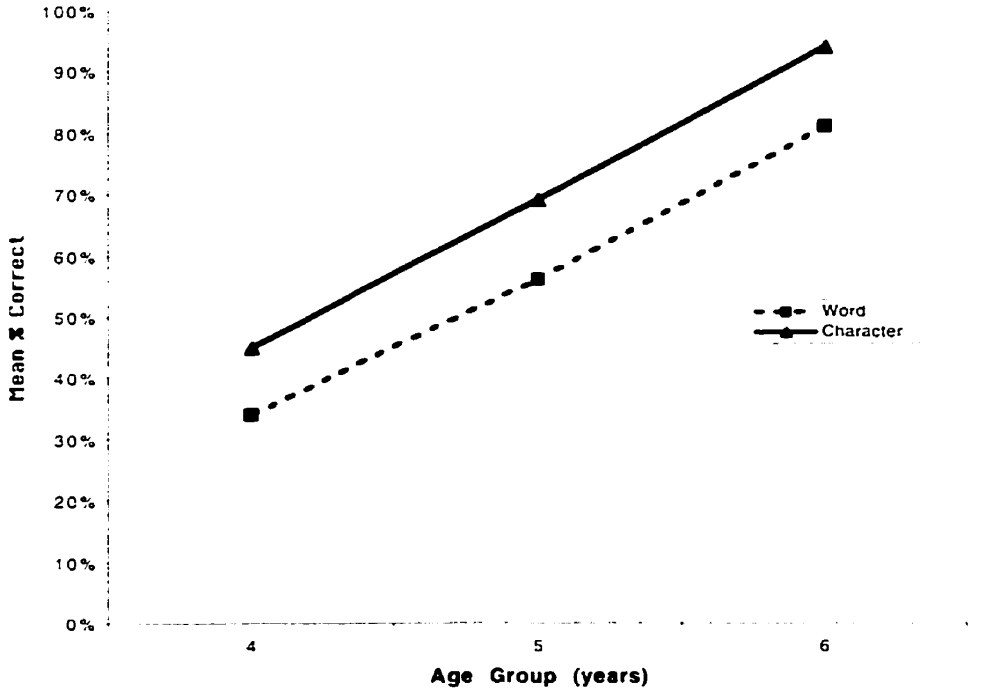

Figure 4b. Metalinguistic Awareness by Concept by Age for Chinese Children (Contrastive Stimuli -- Late Educated Children only)

The 4-way interaction of Culture/Writing System x Age x Concept x Medium was also found to be significant. Simple effects analysis indicated that there was a significant Concept x Medium interaction only for the oldest children from each country: The 6-year-olds in each country scored highest on the text-based tasks for the concept that is represented in their culture's script (i.e., "word" for Canadian and "character" for Chinese children) and scored lowest on the speech-based tasks for the concept that is not represented by their script (i.e., "syllable" for Canadian and "word" for Chinese children). (See Figures 5a and 5b.) The F values for the simple effects analysis are as follows: for the Chinese 4-year-olds, F (1, 95) = 1.54, $p > .21$; for the Chinese 5-year-olds, F (1, 62) = 4.94, $p > .43$; and for the Chinese 6-year-olds, F (1, 95) = 12.06, $p < .005$; for the Canadian 4-year-olds, F (1, 95) = .08, $p > .77$; for the Canadian 5-year-olds, F (1, 95) = .49, $p > .48$; and for the Canadian 6-year-olds, F (1, 95) = 5.47, $p < .05$.

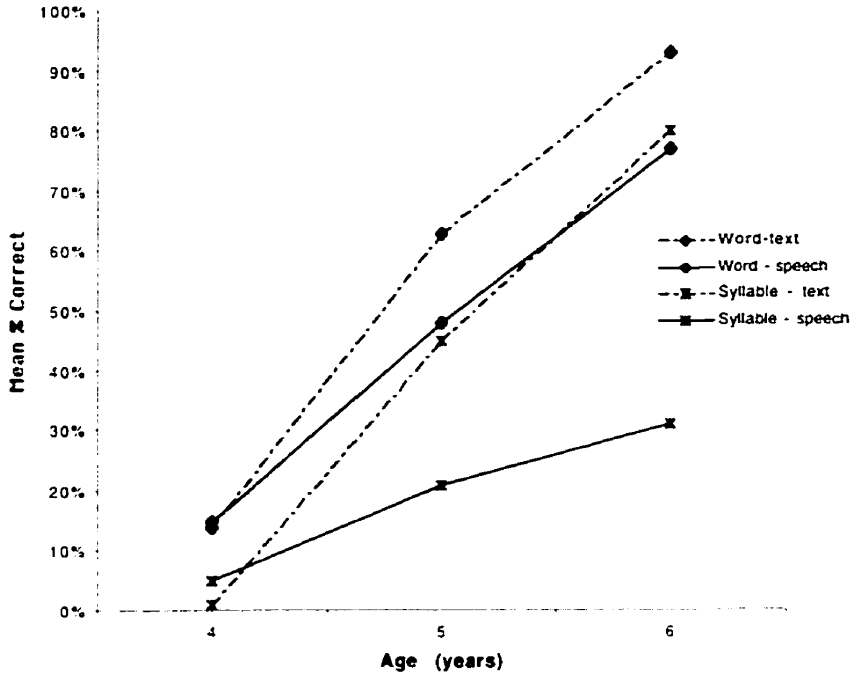

Figure 5a. Metalinguistic Awareness by Concept by Medium by Age: Canadian Children

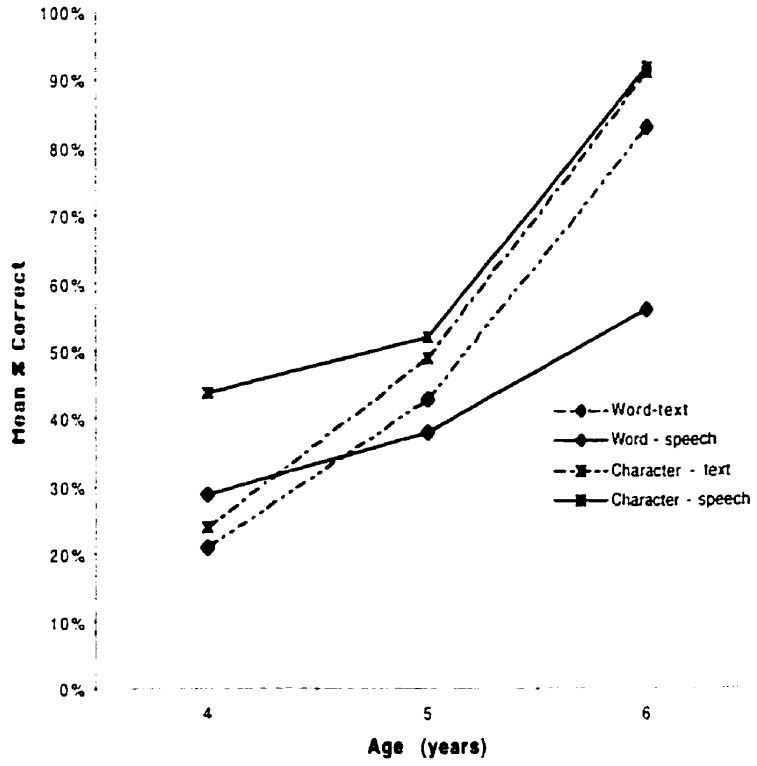

Figure 5b. Metalinguistic Awareness by Concept by Medium by Age: Chinese Children

The next section of the results specifically examines the effects of literacy on the children's awareness of metalinguistic concepts in speech. A number of regression equations were calculated for both of the linguistic concepts (Word and Character/Syllable) for each culture/script (Chinese and English-Canadian). For each condition (Concept x Culture/Script), a step-wise regression was calculated with age entered in the first step and literacy (i.e., score on the text-based tasks) entered in the second step with performance on the speech-based task as the dependent variable. These analyses indicate the extent to which an awareness of text is uniquely contributing to children's performance on the speech-based metalinguistic awareness tasks. For reasons discussed above, only those stimuli in which a "word" strategy and a "character/syllable" strategy yield different answers were used (i.e., only target stimuli from words that were two or more syllables/characters in length were used).

The first set of analyses were conducted with the data from the Canadian children. Children's score on the text-based tasks and Age (in months) were entered as independent variables in two regression equations: one with Word - Speech score as the dependent variable and one with Syllable - Speech score as the dependent variable. The inter-variable correlations are reported in Table 11 for the "word" tasks and Table 12 for the "syllable" tasks.

Table 11

Correlation Matrix for Children's Age (in months) and Total Scores on "Word" Tasks for Canadian Children (n = 41)

	Age	Word-Oral
Age	--	
Word-Oral	.63	--
Word-Text	.72	.87

Table 12

Correlation Matrix for Children's Age (in months) and Total Scores on "Syllable" Tasks for Canadian Children (n = 41)

	Age	Syllable-Oral
Age	--	
Syllable-Oral	.72	--
Syllable-Text	.70	.82

For the Word - Speech score, the overall regression was significant, $R^2 = .76$, $F = 61.25$, $p < .001$; the analysis further revealed that variance was accounted for solely by Word - Text score, $\beta = .87$, $p < .001$, with no additional variance being accounted for by Age, $\beta = .00$, ns. (See Table 13a.) For the Syllable - Speech score, the overall regression equation was again significant, $R^2 = .71$, $F = 46.46$, $p < .001$); the analysis further revealed that variance was accounted for by both Syllable -Text score, $\beta = .61$, $p < .01$, and by Age, $\beta = .30$, $p < .05$. (See Table 13b.)

Table 13

Hierarchical Regression Analysis for Age and Awareness of Text Predicting Speech-based Concepts. Word and Syllable: Canadian Children (N = 41)

a) Prediction of Word - Speech

Variable	B	SE B	β	R^2 (adj)	F	$^{\Delta}R^2$	F($^{\Delta}R^2$)
Step 1 (df = 1)				.39 (.38)	25.30*	-	-
Age (in months)	.02	.00	.63**		*		
Step2 (df = 2)				.87 (.76)	61.25*	.37	59.33*
Age (in months)	.00	.00	-.01 (n.s.)		*		*
Word - Text	.75	.10	.88**				

b) Prediction of Syllable - Speech

Variable	B	SE B	β	R^2 (adj)	F	$^{\Delta}R^2$	F($^{\Delta}R^2$)
Step 1 (df = 1)				.52 (.51)	42.64*	-	-
Age (in months)	.01	.00	.72**		*		
Step2 (df = 2)				.71 (.69)	46.46*	.19	24.53*
Age (in months)	.00	.00	.30*		*		*
Syllable - Text	.20	.04	.61**				

Note. * = $p < .01$; **= $p < .001$

A similar set of analyses were conducted with the data from the Chinese children. Children's score on the text-based task and Age (in months) were entered as independent variables in two regression equations; one with Word - Speech score as the dependent variable and one with Character - Speech score as the dependent variable. The inter-variable correlations are reported in Table 14 for the "word" tasks and Table 15 for the "character" tasks.

Table 14

Correlation Matrix for Children's Age (in months) and Total Scores on "Word" Tasks for Chinese Children (n = 122)

	Age	Word - Oral
Age	--	
Word-Oral	.58	--
Word-Text	.63	.50

Table 15

Correlations for Children's Age (in months) and Total Scores on "Character" Tasks for Chinese Children (n = 122)

	Age	Character-Oral
Age	--	
Character-Oral	.53	--
Character-Text	.60	.61

For the Word - Speech score, the overall regression was significant, $R^2 = .36$, $F = 34.18$, $p < .001$; the analysis further revealed that variance was accounted for both by Age, $\beta = .44$, $p < .001$, and by Word - Text score, $\beta = .87$, $p < .05$. (See Table 16a.) For the Character - Speech score, the overall regression equation was again significant, $R^2 = .41$, $F = 41.39$, $p < .001$); the analysis further revealed that variance was accounted for both by Character -Text score, $\beta = .45$, $p < .001$, and by Age, $\beta = .26$, $p < .01$. (See Table 16b.)

Table 16

Hierarchical Regression Analysis for Age and Awareness of Text Predicting Speech-based Concepts. Word and Character: Chinese Children (N = 122)

a) Prediction of Word - Speech

Variable	B	SE B	β	R^2 (adj)	F	$^{\Delta}R^2$	F($^{\Delta}R^2$)
Block 1 (df = 1)				.34 (.33)	60.82**	-	-
Age (in months)	.02	.00	.58**				
Block 2 (df = 2)				.36 (.35)	34.18**	.03	5.35*
Age (in months)	.01	.00	.44**				
Word - Text	.17	.07	.22*				

b) Prediction of Character - Speech

Variable	B	SE B	β	R^2 (adj)	F	$^{\Delta}R^2$	F($^{\Delta}R^2$)
Block 1 (df = 1)				.28 (.28)	46.94**	-	-
Age (in months)	.01	.00	.53**				
Block 2 (df = 2)				.41 (.40)	41.39**	.13	26.04**
Age (in months)	.01	.00	.26**				
Character - Text	.40	.08	.45**				

Note. * = p < .01; ** = p <.001

The results from the regression equations with the Chinese children indicate that both literacy and age contribute to metalinguistic awareness of Word and Character in speech. However, for Word, more of the variance is accounted for by Age, whereas for Character, more of the variance is accounted for by literacy (as measured by the children's awareness of Characters in writing).

A final set of analyses was conducted to investigate the contributions of age and literacy education to the Chinese children's metalinguistic understanding. This was

possible because, as mentioned above, children in China have the option of beginning primary school at either 5 or 6 years of age. Therefore, for half of the children, formal literacy education begins at age 5 and for half it begins at age 6. The Chinese children in the current study were grouped according to their age and the number of years of literacy education they had received. This generated the following five Age & Literacy groups: 1) four-year-olds, no literacy education; 2) 5-year-olds, no literacy education; 3) 5-year-olds, 1 year of literacy education; 4) 6-year-olds, 1 year of literacy education; and 5) 6-year-olds, 2 years of literacy education. A one-way ANOVA was then conducted with Age & Literacy group as the independent factor and Word - Speech as the dependent factor. A second ANOVA was conducted with Character - Speech as the dependent variable. (Figure 6 illustrates the mean percent correct on Word - Speech and Character - Speech for each Age & Literacy group.) In both cases, pair-wise comparisons were then conducted (Tukey's HSD). Based on the trend found in the regression equations, it was expected that with Word, the groups would differ according to age only (i.e, the four- and five-year-olds would differ significantly from the 6-year-olds). In contrast, with Character, it was hypothesized that the groups would differ according to literacy education only (i.e., the children with no literacy education would differ significantly from those with one or two years of literacy education).

The one-way ANOVA with Word - Speech as the dependent variable indicated a significant effect of Age & Literacy group, $F(4, 117) = 15.80$, $p < .001$. Pairwise comparisons (Tukey HSD) indicated that the 4- and 5-year-olds differed significantly from the 6-year-olds, regardless of the number of years of literacy education. The one-way ANOVA with Character - Speech as the dependent variable also indicated a

significant effect of Age & Literacy group, $F(4, 117) = 16.43$, $p < .001$. Pairwise comparisons (Tukey HSD) indicated that for Character, the 4- and 5-year-olds with no literacy education differed significantly from the 5-year-old and 6-year-olds with at least one year of literacy education (with no difference between the 6-year-olds with one year of education and those with two years of literacy education).

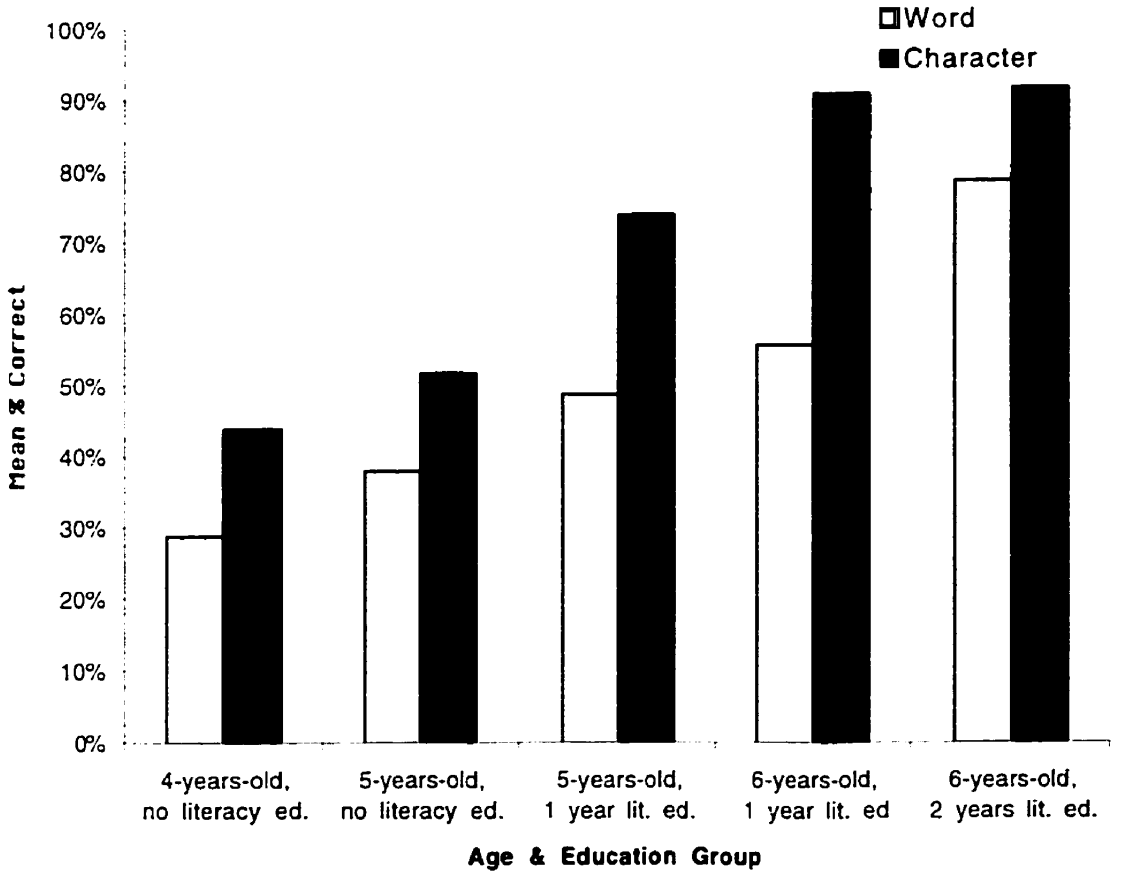

Figure 6. Metalinguistic Awareness in Chinese Children by Linguistic Concept for each Age/Education Group.

To further investigate the unique contributions of age and literacy education to the Chinese children's awareness of the metalinguistic concepts of "word" and "character" in speech, two regression analyses were conducted. Performance on the speech-based

metalinguistic awareness tasks ("word" and "character") were regressed on Age (in months) and Literacy education. A correlation matrix of the variables is presented in Table 17.

Table 17

Correlation Matrix for Chinese Children's Age (in months), Literacy Education, and Speech-based Metalinguistic Awareness Tasks

	Age	Literacy Education
Age	--	
Literacy Education	.87	--
Speech-based Concept of "Word" tasks	.58	.58
Speech-based Concept of "Character" tasks	.53	.55

First, children's understanding of the metalinguistic concept of "word" was examined. For the Word - Speech score, the overall regression was significant, $R^2 = .36$. $F = 33.17$, $p < .001$; the analysis further revealed that variance was accounted for both by Age, $\beta = .31$, $p < .05$, and by Literacy Education, $\beta = .21$, $p < .05$. (See Table 18.)

Table 18

Regression Analysis for Age and Literacy Education Predicting Performance on Speech-based Metalinguistic Awareness of Word

Variable	B	SE B	β	R^2 (adj)	F
				.36 (.35)	33.37**
Age (in months)	.01	.00	.31*		
Literacy Education	.12	.06	.21*		

Note. * = $p < .05$; ** = $p < .001$

Secondly, children's awareness of the concept of "character" was examined. For the Character - Speech score, the overall regression equation was significant, $R^2 = .31$, $F = 26.68$, $p < .001$). However, for "character", variance was accounted for solely by literacy education, $\beta = .35$, $p < .05$, with Age not contributing significantly, $\beta = .23$, $p > .05$. (See Table 19.) It should be noted that these regression should be interpreted cautiously given the colinearity of age and literacy education. Despite this, the pattern of results supports the results as analyzed through the ANOVAs reported earlier.

Table 19

Regression Analysis for Age and Literacy Education Predicting Performance on Speech-based Metalinguistic Awareness of Character

Variable	B	SE B	β	R^2 (adj)	F
				.31 (.30)	26.68**
Age (in months)	.01	.00	.23		
Literacy Education	.14	.06	.35•		

Note. * = $p < .05$; ** = $p < .001$

Discussion

The objective of Study 2 was to use a cross-cultural comparison to investigate the role of literacy in children's acquisition of metalinguistic concepts. According to the proposed multi-factor model of metalinguistic awareness, writing provides a model for children to reflect on speech; children become aware of the concepts that are represented by their culture's writing system. It was therefore hypothesized that the Canadian children would first become aware of words, which are represented in English writing, and that the Chinese children would first become aware of syllable-morphemes, which are represented by characters in the Chinese writing system. Before discussing the findings that relate directly to this hypothesis, however, some of the other findings will be reviewed.

Not surprisingly, children's metalinguistic awareness was found to develop with age. Both the Chinese and Canadian children's average scores on the text- and speech-based metalinguistic tasks for both linguistic concepts (i.e., Word and Character/Syllable) increased with age. This trend is clearly illustrated by Figure 3.

The results also indicated that the 4-year-old Chinese children had a greater metalinguistic awareness than their Canadian counterparts. This difference is explained primarily by the young Chinese children's precocious understanding of character as a unit of speech. The 4-year-old Chinese children had an average score of 44% on the Character-speech task. In contrast, it was not until 5 years of age that the English-speaking Canadian children had a comparable level of awareness of words. (The average score on the word-speech task was 29% for the Canadian 4-year-olds, and 48% for the 5-

year-olds.) Possible explanations for this difference will be discussed in more detail below.

Turning now to the main hypothesis, according to the multi-factor model of metalinguistic awareness, literacy plays a causal role in children becoming aware of certain metalinguistic concepts by providing a model for reflecting on speech. It was therefore hypothesized that there would be cultural differences in the developmental patterns of Chinese and Canadian children's acquisition of metalinguistic concepts, and that this difference would reflect differences in the two culture's writing systems. Specifically, it was predicted that the English-speaking children would first become aware of words and that the Chinese children would first become aware of characters. The results supported this hypothesis. A significant Culture/Writing system x metalinguistic Concept interaction was found: As predicted, the Chinese children were significantly better on the Character/Syllable tasks and the Canadian children were significantly better on the Word tasks.

The fact that Chinese children are more aware of characters and Canadian children are more aware of words does not, by itself, support the claim that literacy plays a causal role in children's acquisition of certain metalinguistic concepts. These differences could also be attributable to differences in the structure of English and Chinese. However, it was further hypothesized that children's awareness of the metalinguistic concepts would be mediated by their understanding of these concepts as units of text. More specifically, it was hypothesized that, for the concept directly represented in each culture's script (i.e., characters in Chinese and words in English), children's performance on the speech-based metalinguistic awareness tasks would be

predicted by their performance on the text-based tasks with these concepts. For the concept not directly represented in the script (i.e., words in Chinese and syllables in English), it was predicted that there would be little or no relation between performance in the two media.

Overall, the results supported the hypotheses. Children's speech-based awareness of the metalinguistic concept that is represented in their culture's script was predicted by their understanding of that concept in text. However, there was also evidence that literacy is related to children's understanding of the concept that is not represented in their culture's writing system. That is, literacy scores predict success in detecting properties of language other than that highlighted by the script.

The English-speaking children's ability to segment speech into words was related to their understanding of words as units of text. A regression analysis revealed that children's performance on the Word-speech tasks was strongly related to their performance on the Word-text task, with no additional variance being accounted for by age. This finding replicates the results of Study 1 and supports the thesis that writing is responsible for providing some of the categories that are used to think about spoken language.

The English-speaking Canadian children's ability to segment speech into syllables was found to be related to both age and literacy. A regression analysis revealed that age alone accounted for 52% of the variance with literacy accounting for a further 19% unique variance. The Canadian children did not score highly on the speech-based syllable tasks; even the 6-years-olds had an average of only 31% correct on the Syllable-speech tasks. This finding differs from other studies in which many 4- and 5-year-olds and most

6-year-olds have been shown to have some awareness of syllables. For example, studies have found that by 5-years-old children can identify which pairs of words share a common syllable (e.g., Treiman & Zukowski, 1991) and can tap a table for each syllable in a word (e.g., Liberman et al., 1974). One possible reason for this discrepancy is that in the previous studies, children are able to respond correctly without having an explicit conception of syllables. For example, in the Treiman and Zukowski study, children may be responding simply by comparing the acoustic stimuli and deciding which are the "most alike". According to the multi-factor model of metalinguistic awareness, this ability starts to develop in the third year when language has become a representational medium for children, and they start to "play" with language. In comparison, the tasks in the current study require children to isolate syllables from a continuous stream of speech. This requires a much more explicit conception of syllables, and also, a greater degree of cognitive control (to use Bialystok's term).

The data from the Chinese children also supports the thesis that literacy plays a causal role in children's metalinguistic awareness of certain concepts. The Chinese children's awareness of characters (i.e., syllable-morphemes) in speech was related to both age and literacy. A regression analysis revealed that, after accounting for age, performance on the text-based character tasks accounted for 19% of the variance on the speech-based character tasks (with age alone accounting for 28% of the variance). This finding supports the claim that literacy is affecting the children's understanding of character, however, the fact that the 4-year-olds Chinese children had an average of 44% correct on the speech-based tasks while performing at around chance on the text-based tasks suggests that they already have some understanding of character as representing a

speech segment. One possible explanation for the difference between the Canadian children's understanding of word and the Chinese children's understanding of character is that, as mentioned in the introduction to this chapter, characters (i.e., syllables-morphemes) are much more clearly distinguished in spoken Chinese than words are in spoken English. Therefore, by the age of 4, Chinese children appear to have an implicit understanding of the unit of speech represented by Characters.

The Chinese children's ability to segment speech into words was almost exclusively explained by age. A regression analysis revealed that age accounted for 34% of the variance on the children's performance on the Word-speech tasks, with performance on the Word-text tasks accounting for only an additional 3% of the variance. Furthermore, when the children were categorized according to age and years of literacy experience, the groups were differentiated by age alone, with no effect of literacy training. (See Figure 4.)

One finding in Study 2 that was not predicted is that literacy is related to children's understanding of concepts that are not represented in their culture's writing system (i.e., word in Chinese and syllable in English). For the English-speaking children, one possible reason for this relation is that in the process of learning to read and write, the children are learning to think of letters to represent syllables prior to thinking of them as representing phonemes (see Vernon, 1993). Another possibility is that the Canadian children were responding to the question, "what is the last sound" with the last phoneme. This answer would be scored as correct, and in fact, some of the older children did use this strategy. (In addition, a few of the 6-year-olds, when asked to give the last sound said the last letter in the word. For example, if the experimenter said "He is running," some

children responded by naming the letter "g".) For the Chinese children, there was a relation between literacy and awareness of the concept of word, however, the relation was considerably less than for the Canadian children and for their concept of syllable. One possible explanation for this relation is that the Chinese children are taught two character words as part of their literacy lessons. (See Figure 2.) By pairing the characters, writing them together and treating them as a single entity may help develop the children's concepts of word. Finally, for both the Chinese and the Canadian children, it may be that, as Vygotsky (1986) originally suggested, the "deliberate and analytical action" of writing forces children to "take cognizance" of the structure of language. Or, as Olson (1994) has suggested, writing may "fix" speech and allow it to become an object of thought.

The results from Study 2 do support the claim that literacy plays a crucial role in children's acquisition of certain metalinguistic awareness by providing a model for reflecting on speech. A comparison of the data from the Canadian and Chinese children suggests, however, that literacy may be playing a slightly different role in each culture. In Chapter 2, it was suggested that the role of literacy in metalinguistic awareness is twofold: it brings into consciousness children's implicit understanding of linguistic concepts, and it presents children with a "theoretical idealization" that they then project onto speech. The results of Study 2 suggest that for Chinese children, learning characters involves the former and for Canadian children, learning words involves the latter. The strongest evidence that the Chinese children have some implicit understanding of characters is that, as mentioned above, the 4-year-olds perform fairly well on the speech-based tasks, even though they show little understanding of characters in text. In addition, there were some Chinese children who did well on the speech-based tasks but did not

correctly answer any of the questions in the text-based tasks. In contrast, at each age level, the Canadian children's performance on the text-based concept of word tasks was as good as or better than their performance on the speech-based tasks, and no English-speaking child who did well on the speech-based tasks did poorly on the text-based tasks. This issue will be discussed in more detail in the following chapter.

Chapter 5: General Discussion

This thesis set out to examine the relation between concepts of writing and concepts for thinking about speech. I advanced a model in which metalinguistic awareness is characterized as a constellation of skills that are acquired at different times and to different degrees throughout childhood. In contrast to previous theories which claimed that metalinguistic awareness is affected only by one or two factors, (i.e., language acquisition, general cognitive development, cognitive control, and literacy), the proposed multi-factor model suggests that each of these factors makes a unique contribution to children's ability to think about language. According to the model, children pass through a series of milestones which have direct implications for metalinguistic awareness. (See Table 1). The current dissertation focused on the last, and arguably the most controversial of these milestone, literacy acquisition.

According to the multi-factor model, writing provides children with a model for reflecting on speech. Through the process of relating written text to spoken language, children become aware of the linguistic categories that are represented by their culture's script (Olson, 1994). It was suggested that literacy serves two functions: it makes children conscious of their implicit linguistic concepts, and it presents children with second-order socially constructed linguistic concepts, that may not have a prior "psychological reality". The two studies presented above examined the role of literacy in Canadian and Chinese children's acquisition of metalinguistic awareness. The general findings support the claim that literacy is directly related to children's metalinguistic awareness. Additionally, although the studies were not specifically designed to

differentiate between the two proposed functions of literacy, the results suggest that literacy plays a slightly different role in the two cultures.

Summary of Findings

Study 1 examined the relation between English-speaking Canadian children's metalinguistic understanding of words in speech and their understanding of words as units of text. The results indicated that children's ability to segment speech into words was predicted by their ability to map written text to speech: Children who could circle where a certain word was written or who could tell what a piece of text said after part of it was covered (even if they could not yet read) were the same children who, when the experimenter stopped in the middle of telling a story, could "say the last word". The results in the first study also indicated that training increases children's metalinguistic awareness of words, more so for older than younger children.

Study 2 extended the findings of the first study in two ways. It examined children from two different cultures, China and Canada, and by looking at two concepts, word and syllable/character. It was hypothesized that children would first become aware of the concept that was represented in their culture's writing system (i.e., words for the Canadian children and characters for the Chinese children), and that this awareness would be mediated by the children's understanding of those concepts as units of text.

Overall, the results of Study 2 supported these hypotheses. The Canadian children demonstrated a greater awareness of words and the Chinese children demonstrated a greater awareness of characters. For both the Canadian and Chinese children, variance on the speech-based tasks that assessed metalinguistic awareness of the concepts that are represented by their culture's scripts was predicted both by performance on the tasks that

assessed understanding of the concepts as units of writing, and to a lesser extent, by age. In contrast, children's awareness of the concept that is not a dominate feature of their culture's script (i.e., syllable for the Canadian children and character for the Chinese children) was related primarily to age, and only marginally related to performance on the text-based tasks.

The findings described above were further supported by an analysis of the effects of age and literacy education on the Chinese children's understanding of character and word. The children were grouped according to their age and their number of years of literacy education. This created 5 groups: 4-year-olds with no literacy education, 5-year-olds with no literacy education, 5-year-olds with 1 year of literacy education, 6-year-olds with 1 year of literacy education, and 6-year-olds with 2 years of literacy education. Whereas the groups' mean scores on the speech-based concept of word tasks differed according to age (i.e., the two groups of 6-year-olds were better than the 4- and 5-year-olds), for character, the groups differed according to literacy education (i.e., the 4- and 5-year-olds with no literacy training differed from the 5- and 6-year-olds with at least one year of training).

The results from both cultural groups support the claim that literacy provides a model for children to think about language, however, the data suggest that this process may be different for the Canadian and Chinese children. The youngest Canadian children demonstrated little awareness of words in either medium. With the older Canadian children, as their performance on the text-based word task increased, so did their metalinguistic understanding of words in speech. This relation was also found for the older Chinese children's understanding of character. With the 4-year-old Chinese

children, however, even though they did poorly on the other tasks (including the text-based character task), they did fairly well on the speech-based character task (with an average score of 44%). In other words, although the English-speaking children did not demonstrate any metalinguistic understanding of words before they understood words in text, the Chinese children demonstrated some awareness of character in speech prior to understanding characters in writing (although this awareness does dramatically improve as the children learned the Chinese script). These findings are what would be expected if the English-speaking children are actually learning a new concept whereas the Chinese children are having an implicit concept made explicit and conscious. This would be the case if words are second-order socially constructed linguistic concepts and characters have a psychological reality (i.e., are actually used in the process of understanding spoken Chinese).

Relation of Findings to Theories of Metalinguistic Awareness

The findings described above are best explained by the multi-factor model of metalinguistic awareness; other theories do not fully account for the findings. According to a Piagetian explanation, developments in metalinguistic awareness are continuous with other, more general cognitive developments. It is the ability to engage in reflective abstraction, which is acquired in the transition from pre-operational to concrete-operational thought, that allows children to move from just using language to becoming aware of the properties and form of language (Hakes, 1980). A Piagetian explanation for the relation between literacy and metalinguistic awareness that was found in the current study might be that the same cognitive skill (e.g., reflective abstraction) underlies both. However, this would not explain why the relation was primarily found for concepts that

were represented by the culture's script. Furthermore, the transition from pre-operational to concrete operation thought, and hence the development of the ability to engage in reflective abstraction, is expected to occur around the age of 7. In the current study, by 5 years of age, the children's average scores on the metalinguistic tasks for the concept represented by their writing system was above 50%.

According to Bialystok (1986b; 1993; 1999), there are two components to metalinguistic awareness: analysis (the ability to represent language) and cognitive control (the ability to selectively attend to specific aspects of a representation). Bialystok (1988, 1999) has demonstrated that learning a second language increases children's levels of cognitive control, and therefore improves their performance on metalinguistic awareness tasks that require increased control. On the other hand, Bialystok argues that analysis is not affected by bilingualism. The findings of the current study do not contradict the analysis-control model of metalinguistic awareness. It may be that, similar to bilingualism, literacy is related to increased levels of control. However, if literacy was only related to children's ability to selectively attend to representations, then the effects of literacy should not have been different for the two concepts (i.e., word and syllable/character). The results from Study 2 therefore suggest that literacy is also related to increased levels of analysis.

Bialystok (1992) suggests that analysis is developed through the process described in Karmiloff-Smith's representational redescription (RR) model of cognitive development. According to Karmiloff-Smith (1992), children develop procedures for interacting with the world. Once a child has mastered a certain behavior, their representation of this procedure is "recoded" into a more abstract and explicit format.

According to the RR model, children's representations pass through several levels, each of which is more abstract and more readily available to consciousness. The process of representational redescription is posited to occur solely due to "system internal dynamics", with children's experiences having no effect on the subsequent representations. According to the RR model, metalinguistic awareness develops as children's procedural representations for speaking become recoded into higher-level formats. Karmiloff-Smith et al.'s (1996) supported the RR explanation of metalinguistic awareness by demonstrating that children as young as 4 years of age can succeed on a more "on-line" task to access their understanding of the concept of word. This led the authors to suggest that "metalinguistic awareness could turn out to be a part of language acquisition itself, rather than the mere product of literacy" (p. 215). However, data from the current studies indicates that children who are able to do the more "on-line" metalinguistic awareness tasks for words and characters are also aware of these concepts as units of text. When considered along with the anthropological data presented in Study 1, the current findings suggest that -- as predicted by the multi-factor model -- literacy is crucial to certain aspects of metalinguistic awareness.

Future Directions for Research

There are limitations to the current studies that need to be addressed in future research. One limitation is the correlational nature of the findings. The data indicate that for Chinese children, an awareness of character as a unit of text is related to an increased awareness of characters in speech, and for Canadian children, an awareness of word as a unit of text is related an increased awareness of words in speech. However, these correlations do not necessarily imply causality. It could be the case that children develop

an awareness of these concepts and then apply it to both speech and text. (However, this would not explain why there is a difference between children's awareness of the two concepts investigated in Study 2.) It may also be the case that there is a "third factor" (e.g., general cognitive development) that explains both developments. One way to address this issue would be to undertake a longitudinal study. If an understanding of text is behind children being aware of these metalinguistic concepts, then there should be no point at which children are able to demonstrate an awareness of word in speech that they are not also able to demonstrate an awareness of word as a piece of text. Another way to address the correlational issue would be to adopt a true experimental design and undertake a training study. Compared to a control group, children who are taught and given opportunity to explore writing should demonstrate increased awareness of the concepts that are represented in the writing system. (However, identifying an appropriate control for this study might be somewhat problematic.)

Another possible criticism of Study 2 is one that applies to all cross-cultural studies: there are many differences between two cultures and it is impossible to say with absolute certainty that the observed differences are due to the factors claimed. In the current study, it was claimed that differences between the Canadian and Chinese children's awareness of words and characters/syllables was due to differences in the two culture's writing systems. However, as mentioned in the discussion to Study 2, differences in the structure of the language may also be having an effect. A better comparison may be between a literate and non-literate group within the same culture (although there will most likely be other important differences between members of a culture who are literate and those that are not). An even better comparison would be

between members of the same culture who have learned different scripts to represent their language. The research on phonological awareness in Chinese children and adults who have learned pinyin (or another alphabetic script) has, in fact, done this. As previously mentioned, this research indicates that there is an increase in phonological awareness that is related to learning pinyin, but not to learning characters (Huang & Hanley, 1997) and that adults who have learned pinyin show significantly more phonological awareness that those who have only learned characters (Read et al., 1986).

Yet another direction for future research would be to investigate other linguistic concepts. For example, the model predicts that there will be a relation between English-speaking children's understanding of letters and their phonological awareness (similar to what has been found for pinyin with Chinese children). Additional support for the role of literacy in metalinguistic awareness would also come from the study of other cultures with different writing systems.

According to the multi-factor model presented in Chapter 2, there are several "milestones" that lead to advances in metalinguistic awareness. The current dissertation focused on literacy, the last of these milestones. However, several predictions can be made about the other milestones. For example, it is suggested that sometime around the fourth year, children acquire the ability to hold in mind multiple representations of the same object. It has been argued that this ability is related to certain developments in children's theory of mind, such as the "appearance-reality distinction" (i.e., differentiating between what an object looks like and what it is really). According to the proposed model, children who can make the appearance-reality distinction should also be

able to begin attending to the form, as well as the meaning of language. This hypothesis should be tested in future research.

Relation of Findings to Theories of Cognitive Development

The findings of the current dissertation have implications not only for early literacy and metalinguistic awareness, but also, more generally, for theories of cognitive development. The investigation of how literacy affects children's conception of language serves as a specific instance of a more general question under active investigation in developmental psychology, namely, how do external representations or symbols operate to effect changes in mental knowledge structures (K. Nelson, personal communication, October 14, 1999)? How does seeing or hearing a representation of something known on an implicit level transform that knowledge into an explicit and more conscious form?

One set of theories have argued that children's explicit, conscious knowledge is derived solely from their implicit, procedural representations. This approach has been led by the RR theory of Karmiloff-Smith (1992). As mentioned above, Karmiloff-Smith argues that children first develop an "encapsulated" procedural representation for interact with the world. Explicit and conscious knowledge is acquired through a process of "representational redescription" during which a procedural representation is recoded into more abstract formats. This redescription is brought about solely through "system-internal dynamics", with external stimuli having little or no effect.

Another group of theorists, whose theories are more Vygotskian in nature, argue that children's explicit, conscious knowledge is greatly affected by the cognitive tools and representational systems found in their culture. This claim is supported by Nelson (1996) who argues that much of cognitive development involves children acquiring

representational systems of increasing power and generality -- representational systems that are found in their culture. According to Nelson, it is language and its derivatives (e.g., writing, graphic forms, etc.) that drives much of cognitive development by providing new ways of formulating and representing knowledge. Nelson does acknowledge, however, that not all developments are dependent upon language. She suggests that to fully understand the nature of cognitive development will require knowledge of developments that depend on language as well as those that do not.

The current studies provide analogous examples of developments in metalinguistic awareness, some of which are affected by literacy (e.g., English-speaking Canadian children's concept of word) and some of which are not (e.g., English-speaking Canadian children's concept of "syllable"). In the same way that language has been hypothesized to affect cognition by providing new ways of representing knowledge, literacy affects metalinguistic awareness by providing new ways of formulating and representing spoken language.

Summary

The current thesis argues that metalinguistic awareness is not a single ability, but instead, a series of skills that children acquire at different times and to different extents throughout development. A multi-factor model was presented according to which these skills are acquired through a variety of factors, including general cognitive developments, language acquisition, and literacy. Two studies were presented that examined the last of these factors, literacy.

The first study found that children's understanding of words in text, rather than age, predicted their ability to segment speech into words. The second study investigated

literacy and metaliguistic awareness in English-speaking Canadian and Mandarin-Speaking Chinese children. Although there were some differences between the two cultures (mainly the Chinese children's precocious awareness of Characters in speech), overall, the children's awareness of linguistic concepts in text predicted their understanding the concepts as units of speech.

Taken together, the results of the two studies support the hypothesis that literacy plays a causal role in children's metalinguistic understanding. For children, learning to read and write is not only learning a new medium, but also learning to think about their speech in new ways.

References

Anglin, J. M. (1993). Vocabulary development: A morphological analysis. Monographs of the Society for Research in Child Development, 58(10).

Bialystok, E. (1986a). Children's concept of word. Journal of Psycholinguistic Research, 15, 13-32.

Bialystok, E. (1986b). Factors in the growth of linguistic awareness. Child Development, 57, 498-510.

Bialystok, E. (1988). Levels of bilingualism and levels of linguistic awareness. Developmental Psychology, 24, 560-567.

Bialystok, E. (1992). Attentional control in children's metalinguistic performance and measures of field independence. Developmental Psychology, 28, 654-664.

Bialystok, E. (1993). Metalinguistic awareness: The development of children's representations of language. In C. Pratt & A. Garton (Eds.), Systems of representation in children: Development and use. (pp. 211-233). London: Wiley & Sons.

Bialystok, E. (1999). Cognitive Complexity and Attentional Control in the Bilingual Mind. Cognitive Development, 70, 636-644.

Birdsong, D. (1989). Metalinguistic performance and interlinguistic competence. Berlin: Springer-Verlag.

Boltz, W. G. (1996). Early Chinese Writing. In P. Daniels, T. & W. Bright (Eds.), The World's Writing Systems (pp. 191-199). New York: Oxford University Press.

Bradley, L., & Bryant, P. E. (1983). Categorizing sounds and learning to read -- A causal connection. Nature (London), 301, 419-421.

Chi, M. (1988). Invented spelling/writing in Chinese-speaking children: The developmental patterns. National Reading Conference Yearbook, 37, 285-296.

Clay, M. M. (1991). Becoming literate: The construction of inner control. Portsmouth, NH: Heinemann.

DeFrancis, J. (1984). The Chinese language : fact and fantasy. Honolulu: University of Hawaii Press.

DeVilliers, P. A., & DeVilliers, J. G. (1972). Early judgements of semantic and syntactic acceptability by children. Journal of Psycholoinguistic Research, 1, 299-310.

Dowing, J., & Oliver, P. (1974). The child's concept of a word. Reading Research Quarterly, 9, 568-582.

Downing, J., & Leong, C. K. (1982). Psychology of Reading. New York: Macmillan.

Ehri, L. C. (1985). Effects of printed language acquisition on speech. In D. R. Olson, N. Torrance, & A. Hildyard (Eds.), Literacy, language and learning: The nature and consequences of reading and writing (pp. 333-367). Cambridge: Cambridge University Press.

Fan, L., Tong, L., & Song, J. (1987). The characteristics of Chinese language and children's learning to read and write. In D. A. Wagner (Ed.), The future of literacy in a changing world (pp. 87-94). New York: Permgamon Press.

Ferreiro, E. (1985). Literacy development: Psychogenetic perspective. In D. Olson, N. Torrance, & A. Hildyard (Eds.), Literacy, language and learning (pp. 217-228). New York, NY: Cambridge University Press.

Ferreiro, E. (1994). Literacy development: construction and reconstruction. In D. Tirosh (Ed.), Implicit and explicit knowledge: An educational approach (Vol. 6, pp. 169-180). Norwood, NJ: Ablex.

Ferreiro, E. (1996). The acquisition of cultural objects: The case of written language. Prospects, XXVI(1), 131-140.

Ferreiro, E., & Teberosky, A. (1982). Literacy Before Schooling (Siglo Veintiuno, Trans.). Heinemann: Exeter, N.H. & Londres. (Original work published in 1979)

Finnegan, R. (1977). Oral poetry: It's nature, significance, and social context. Cambridge: Cambridge University Press.

Fox, B., & Routh, D. K. (1975). Analysing spoken language into words, syllables, and phonemes: A developmental study. Journal of Psycholinguistic Research, 4(4), 331-342.

Francis, H. (1975). Language in childhood: Form and function in language learning. London: Paul Elek.

Gleitman, H., Gleitman, L. R., & Shipley, E. (1972). The emergence of the child as grammarian. Cognition, 1(2-3), 137-164.

Goody, J. (1971). The domestication of the savage mind. Cambridge, England: Cambridge University Press.

Hakes, D. H. (1980). The development of metalinguistic abilities in children. (Vol. 9). Berlin: Springer-Verlag.

Harris, R. (1980). The Language-Makers. London: Duckworth.

Harris, R. (1989). How does writing restructure thought? Language and Communication, 9, 99-106.

Harris, R. (1997). From an Integrational Point of View. In G. Wolf & N. Love (Eds.), Linguistics Inside Out: Roy Harris and His Critics (Vol. 148, pp. 229-310). Philadelphia: John Benjamins Publishing Co.

Ho, C. S., & Bryant, P. (1997). Development of phonological awareness of Chinese children in Hong Kong. Journal of Psycholinguisitic Research, 26(1), 109-126.

Homer, B. D., & Olson, D. R. (1999). Literacy and children's conception of words. Written language and literacy, 2(1), 113-137.

Huang, H. S., & Hanley, J. R. (1997). A longitudinal study of phonological awareness, visual skills, and Chinese reading acquisition among first-graders in Taiwan. International Journal of Behavioral Development, 20(2), 249-268.

Jiange, S., & Li, B. (1985). A glimpse at reading instruction in China. Reading Teacher, 38(8), 762-766.

Karmiloff-Smith, A. (1979). A functional approach to child language: A study of determiners and reference. Cambridge: Cambridge University Press.

Karmiloff-Smith, A. (1986). From metaprocesses to conscious access: Evidence from children's metalinguistic and repair data. Cognition, 23, 95-147.

Karmiloff-Smith, A. (1992). Beyond modularity: A developmental perspective on cognitive science. Cambridge, MA: MIT Press.

Karmiloff-Smith, A., Grant, J., Sims, K., Jones, M., & Cuckle, P. (1996). Rethinking metalinguistic awareness: Representing and accessing knowledge about what counts as a 'word'. Cognition, 58, 197-219.

Kirtley, C., Bryant, P., MacLean, M., & Bradley, L. (1989). Rhyme, Rime, and the onset of reading. Journal of Experimental Child Psychology, 48, 224-245.

Leong, C. K., & Haines, C. F. (1978). Beginning readers' analysis of words and sentences. Journal of Reading Behavior, 10(4), 393-407.

Levi-Bruhl, L. (1923). Primitive Mentality. London: George Allen & Unwin. (Original work published in 1910)

Liberman, I. Y., Shankweiler, D., Fischer, F. W., & Carter, B. (1974). Explicit syllable and phoneme segmentation in the young child. Journal of Experimental Child Psychology, 18(2), 201-212.

Macnamara, J. (1982). Names for things. Cambridge: MIT Press.

Magnusson, E., & Naucler, K. (1993). The development of linguistic awareness. First Language, 37, 93-112.

Mair, V. H. (1996). Modern Chinese Writing. In P. Daniels, T. & W. Bright (Eds.), The World's Writing Systems (pp. 200-208). New York: Oxford University Press.

Miller, G. D. (1994). Ancient scripts and phonological knowledge. Philadelphia: John Benjamins.

Nelson, K. (1996). Language in cognitive development: Emergence of the mediated mind. New York: Cambridge University Press.

Nelson, K., & Lucariello, J. (1985). The development of meaning in first words. In M. D. Barrett (Ed.), Children's single-word speech . Chichester, England: Wiley.

Olson, D. R. (1994). The world on paper. Cambridge: Cambridge University Press.

Owen, P. P., P. (Ed.). (1995). Emergent and Developing Reading: Messages for teachers. (Vol. 1). Washington, DC: The Falmer Press.

Papandropoulou, I. (1978). An experimental study of children's ideas about language. In R. J. Sinclair, W. J. Jarvella, & M. Levelt (Eds.), The Child's conception of language (pp. 55-64). New York: Springer-Verlag.

Papandropoulou, I., & Sinclair, H. (1974). What is a word? Experimental study of children's ideas on grammar. Human-Development, 17(4), 241-258.

Piaget, J. (1929). The child's conception of the world. London: Routledge and Kegan Paul.

Piaget, J. (1976). The Grasp of Consciousness: Action and Concept in the Young Child. Cambridge, MA: Harvard University Press.

Piaget, J. (1978). Success and understanding (Arnold J. Pomerans, Trans.). Cambridge: Harvard University Press. (Original work published in 1974)

Read, C. A., Zhang, Y., Nie, H., & Ding, B. (1986). The ability to manipulate speech sounds depends on knowing alphabetic reading. Cognition, 24, 31-44.

Reid, J. (1966). Learning to think about reading. Educational Research, 9, 56-62.

Rousseau, J.-J. (1966). Essay on the origin of languages. In J. H. Moran & A. Gode (Eds.), On the origin of language: Two Essays by Jean-Jacques Rousseau and Johann Gottfried Herder . New York: Frederick Unger. (Original work published 1754-91)

Sampson, G. (1985). Writing Systems: A linguistic Introduction. Stanford, CA: Stanford University Press.

Scholes, R. J. (1993). On the orthographic basis of morphology. In R. J. Scholes (Ed.), Literacy and language analysis (pp. 73-95). Hillsdale, NJ: Lawrence Erlbaum Associates.

Scribner, S., & Cole, M. (1981). The psychology of literacy. Cambridge: Harvard University Press.

Shu, H., & Anderson, R. C. (1999). Learning to Read Chinese: The Development of metalinguistic awareness. In J. Wang, A. Inhoff, & H.-C. Chen (Eds.), Reading Chinese script: A cognitive analysis (pp. 1-18). London: Lawrence Erlbaum Associates.

Sinclair, H. (1978). Conceptualization and awareness in Piaget's theory and its relevance to the child's conception of language. In A. Sinclair, R. J. Jarvella, & W. J. M. Levelt (Eds.), The child's conception of language (Vol. 2, pp. 191-200). New York: Springer-Verlag.

Smith, C. L., & Tager-Flusberg, H. (1982). Metalinguistic awareness and language development. Journal of Experimental Child Psychology, 34(3), 449-468.

Taylor, I., & Taylor, M. M. (1995). Writing and Literacy in Chinese, Korean, and Japanese. Philadephia: John Benjamins.

Teale, W. H., and Sulzby, E. (Ed.). (1986). Emergent literacy: Writing and reading. Norwood, NJ: Ablex.

Templeton, S. (1986). Metalinguistic awareness: A synthesis and beyond. In D. B. Yaden & S. Templeton (Eds.), Metalinguistic awareness and beginning literacy: Conceptualizing what it means to read and write (pp. 293-310). Portsmouth, NH: Heinemann.

Treiman, R., & Zukowski, A. (1991). Levels of phonological awareness. In S. A. Brady & D. P. Shankweiler (Eds.), Phonological Processes in Literacy: A tribute to Isabelle Y. Liberman (pp. 67-83). Hillsdale, NJ: Lawrence Erlbaum Associates.

Vernon, S. (1993). Initial Sound/Letter Correspondences in Children's Early Written Productions. Journal of Research in Childhood Education, 8(1), 12-22.

Vygotsky, L. S. (1986). Thought and language (Kazulin, A., Trans.). Cambridge: MIT Press. (Original work published in 1934)

Weir, R. H. (1962). Language in the crib. The Hague: Mouton.

Appendix A: Protocols for Study 1

Speech-Based Tasks

Word Repeat - Story

Pre-Test

Total Score /20

Children are read the following story. During the story, the experimenter stops occasionally (at the underlined words) and asks the children to "repeat the last word I said". [Note: the stories were counterbalanced between the pretest and post-test.]

E - Once upon a time, there were 3 little pigs. These 3 pigs were brothers. One day, the time came for the pigs to set off and build their own houses.

The first pig decided to build a house out of straw. "It will be so easy to get the straw and so quick to build!" he though. So this pig collected straw from a farmer's field and that very same day, he built his little house. So in only one day, he had his house of straw.

The second pig decided that he would build his house out of wood. "There are many trees around," he thought. " A wood house will be more work than a straw house, but it will be stronger." The second pig two days building his house of wood.

The third little pig decided to build his house from bricks. "It will take a lot of work to make a house with bricks but when I am done, I will have a very, very strong house!" he thought. So the third pig spent four whole days building his house!

A little while after the pigs had built their houses, the big bad wolf decided that he wanted to eat a pig! He went to the first pig's house of straw.

"Little pig, little pig, let me come in!" he cried.

"Not by the hair of my chinny, chin, chin!" said the first pig.

"Then I will huff, and puff, and blow your house in!" And the big bad wolf took a big breathe and blew down the straw house! The first little pig quickly ran to his brother's house.

So the big bad wolf went to the second pig's house of wood.

"Little pigs, little pigs, let me come in!" he cried.

"No! Not by the hair of our chinny, chin, chins!" said the first and the second pigs.

"Then I will huff, and puff, and blow your house in!" And the big bad wolf took a big breathe and blew down the wood house! The first and second little pigs very quickly ran to their brother's house.

So the big bad wolf went to the third pig's house of bricks.

"Little pigs, little pigs, let me in!" he cried.

"Not by the hair of our chinny, chin, chins!" said all three pig.

"Then I will huff, and puff, and blow your house in!" And the big bad wolf took a big breathe and blew at the brick house! Nothing happened. So the wolf took another big breathe and blew again. Still nothing happened. No matter how much he tried, the wolf could not blow down the brick house. Finally, the wolf was too tired and so he went away without a pig to eat and the pigs lived happily ever after.

Training Task

E - Now I'm going to say something to you and I want you to tell me the last word that I say, only the last word.

1) Big bird is yellow / _____
2) Grover is blue / _____
3) Bert likes pigeons / _____
4) Ugly green hair / _____
5) White dove feather / _____
6) Chocolate chip cookies / _____
7) The big game / _____
8) Shiny red apple / _____
9) Big blue sea / _____
10) The big fish / _____

(The task continues with corrective feedback for 10 turns or until the child gets 2 consecutive trials correct.)

Post-test

Total Score /20

Children are read the following story. During the story, the experimenter stops occasionally (at the underlined words) and asks the children to "repeat the last word I said".

E - A mother bird sat on her egg. The egg jumped. "Oh oh!" said the mother bird. "My baby will be here! He will want something to eat. I must get something for my baby bird to eat!" she said. "I will be back!" So away she went.

The egg jumped. It jumped and jumped and jumped! Out came the baby bird! "Where is my Mother?" he said. He looked for her. He looked up. He did not see her. He looked down. He did not see her. "I will go and look for her," he said. So away he went. Down, out of the tree he went. Down, down, down! It was a long way down.

The baby bird could not fly. He could not fly, but he could walk! "Now I will go and find my mother," he said. He did not know what his mother looked like. He went right by her! He did not see her.

He came to a kitten. "Are you my mother?" he said to the kitten. The kitten just looked and looked. It did not say a thing. The kitten was not his mother. so he went on.

Then he came to a hen. "Are you my mother?" he said to the hen. "No," said the hen.

The kitten was not his mother. The hen was not his mother. So the baby bird went on. "I have to find my mother!" he said. "But where? Where is she? Where could she be?"

Then he came to a dog. "Are you my mother?" he said to the dog. "I am not you mother. I am a dog," said the dog. So the baby bird went on.

Now he came to a cow. "Are you my mother?" he said to the cow. "How could I be your mother?" said the cow. "I am a cow."

The kitten and the hen were not his mother. The dog and the cow ere not his mother. Did he have a mother? "I did have a mother," said the baby bird. "I know I did. I have to find her. I will. I will!"

Now the baby bird did not walk. He ran! The baby bird did not stop. He ran on and on.

He looked way, way up. He saw a big plane. "Here I am, Mother," he called out. But the plane did not stop. The plane went on.

Just then, the baby bird say a big thing. This must be his mother! "There she is! There is my mother!"

He ran right up to it. "Mother, Mother! Here I am Mother!" he said to the big thing.

The big thing just said, "Snort."

"Oh, you are not my mother," said the baby bird. "You are a Snort. I have to get out of here!"

But the baby bird cold not get away. The snort went up. It went way, way up. And up, up, up went the baby bird.

Then the Snort started to move.

"Oh, oh, oh! What is this Snort going to do to me? Get me out of here!"

Then the Snort came to a stop.

"Where am I?" said the baby bird. "I want to go home! I want my mother!"

Then something happened. The Snort put the baby bird back into the tree! The baby bird way home!

Just then, the mother bird came back to the tree. "Do you know who I am?" she said to the baby bird.

"Yes, I know who you are," said the baby bird. "you are not a kitten. You are not a hen. You are not a dog. You are not a cow. You are not a plane or a Snort. You are a bird, and you are my Mother!"

Text Based Tasks

Word Count (Omitted Task)

Children are shown a brief piece of text and asked to count the number of words in the text. This is done with two phrases: "Three little pigs" and "Bruce baked four cakes".

Word Cover

Total Score /5

A piece of text (e.g., "Three little pigs") is shown and read to the children by the experimenter. The experimenter then covers one word at a time, asking the children "What does this say now?" (e.g., "XXXX little pigs" -- "What does this say now?") This is done for one 3-word phrase ("Three little pigs") and one 4-word phrase ("Bruce baked four cakes").

Word Circle

Total Score /12

Children are given a pencil and then shown a series of pictures with sentences underneath. The experimenter reads the sentence while pointing to the words as he reads. The children are then asked to circle "where it says X" where X is the underlined word in the sentences below.

1. He looked up.
2. Then something happened.
3. So away he went.
4. "No," said the hen.
5. Then the plane went on.
6. He looked for her.
7. Out came the baby bird!
8. He came to a kitten.
9. He looked down.
10. He did not see her.
11. So away she went.
12 The egg jumped.

Appendix B: Protocols for Study 2

Word Tasks

Word Repetition - List (Training Task)

E - I'm going to say some things to you. When I stop, I want you to say the last word I said. Not the whole thing, just the last word.

Total Score (____/8)

1. He is swimming	(verb, 2+)
2. Mother bought a book	(noun, 1)
3. The plane flew	(verb, 1).
4. Jenny is going to play.	(verb, 1).
5. This is a rooster	(noun, 2+)
6. It is Mickey Mouse's birthday.	(noun, 2+)
7. The flower opened	(verb, 2+).
8. She has a cat	(noun, 1).

(The task continues with corrective feedback for 10 sentences.)

Word Repetition - Story

Children are read the following story. During the story, the experimenter stops occasionally (at the underlined words) and asks the children to "repeat the last word I said". [Note: there are two stories which were counterbalanced between the "Word" and "Syllable/Character" tasks.]

Scoring: Pretest (____/5); Noun1 (__/4); Noun2+ (__/4); Verb 1 (__/4); Verb2+ (__/4); Functor (__/4): Total Score (__/20)

One day, a little girl went to see her Grandma. The girl's name was Hood. Her Mom gave her honey and eggs to take to her Grandma. Hood waved good bye.

As she was walking near the woods, she met a wolf.

The wolf asked: "Where are you going?" Hood said: " To see Grandma."

Off he ran to Grandma's house. Grandma saw the wolf coming. She hid under the table.

The wolf went into the house. He got into bed. He put on Grandma's nightcap and night dresses. His ears stuck out. He looked funny.

After several minutes, Hood arrived at Grandma's house. When Hood came into the door, she saw Grandma on the bed. She said: "what big ears you have, Grandma." The wolf said: "all the better to listen to you." "What big eyes you have, Grandma" she said. "Yes, and big teeth to eat you!" said the wolf.

"Oh, no!" shouted Hood. "you are not my Grandma!" She ran outside and cried loudly "Help me!". The wolf ran after her. But a woodcutter nearby heard Hood cry "Help!" The woodcutter ran quickly there, scaring the wolf into the woods. Then the woodcutter took Hood back to Grandma's house, and found her grandma. Now they were safe and happy. The wolf was never seen again.

Word Circle Task

Total Score (___/12)

E - I am going to read a few sentences. You have to listen very carefully. After I finish each sentence, I am going to ask you to circle a word with the pencil. For example, this says "He forgot to bring his book". If I ask you to circle "forgot ", you circle here.

1. This garden is pretty (noun, 2+).
2. They are running (verb , 2+).
3. They enjoy dancing (verb, 2+).
4. Bruce sat on the chair (verb, 1).
5. John went to school (verb, 1).
6. The ball rolled off the table (functor, 1).
7. Mary's home is very big (noun, 1).
8. The glass is on the table (functor, 1).
9. The red bird flew away (noun, 1).
10. We watched a football game (noun, 2+).
11. Wash before you eat (functor, 2).
12. The balloon is over the tree (functor, 2).

Word Cover

E - I am going to read you something written on this paper. Then, I am going to cover up part of it and I want you to tell me what the rest of it says. This says: "three pretty deer." "What does it say?" (etc.) Cover up the first word.

Word Match/Syllable Mismatch (to number in phrase)

Total Score (__/2)

~~Three~~ pretty deer (cover one)

~~Three pretty~~ deer (cover two)

Word Misatch/Syllable Match (to number in phrase)

Total Score (__/2)

~~four~~ dirty mice (cover one)

~~four dirty~~ mice (cover two).

Word Cover - Other Language

Total Score (___/4)

(Same task as above except that Chinese writing is used)

Syllable/Character Tasks

Syllable Repetition - List

E - I'm going to say some things to you. When I stop, I want you to say the last sound I said. Not the whole thing, just the last sound. [For the Chinese children, "the last character" is asked for instead of "the last sound".]

Total Score (____/8)

1. He is swimming	(verb, 2+)
2. Mother bought a book	(noun, 1)
3. The plane flew	(verb, 1).
4. Jenny is going to play.	(verb, 1).
5. This is a rooster	(noun, 2+)
6. It is Mickey Mouse's birthday.	(noun, 2+)
7. The flower opened	(verb, 2+).
8. She has a cat	(noun, 1).

(The task continues with corrective feedback for 10 sentences.)

Syllable Repetition: Story

Children are read the following story. During the story, the experimenter stops occasionally (at the underlined words) and asks the children to "repeat the last sound I said".

Scoring: Pretest (____/5); Noun1 (__/4); Noun2+ (__/4); Verb 1 (__/4); Verb2+ (__/4); Functor (__/4): Total Score (__/20)

E - One day, a little girl went to see her Grandma. The girl's name was Hood. Her Mom gave her honey and eggs to take to her Grandma. Hood waved good bye.
As she was walking near the woods, she met a wolf.
The wolf asked: "Where are you going?" Hood said: " To see Grandma."
Off he ran to Grandma's house. Grandma saw the wolf coming. She hid under the table.
The wolf went into the house. He got into bed. He put on Grandma's nightcap and night dresses. His ears stuck out. He looked funny.

After several minutes, Hood arrived at Grandma's house. When Hood came into the door, she saw Grandma on the bed. She said: "what big ears you have, Grandma." The wolf said: "all the better to listen to you." "What big eyes you have, Grandma" she said. "Yes, and big teeth to eat you!" said the wolf.

"Oh, no!" shouted Hood. "you are not my Grandma!" She ran outside and cried loudly "Help me!". The wolf ran after her. But a woodcutter nearby heard Hood cry "Help!" The woodcutter ran quickly there, scaring the wolf into the woods. Then the woodcutter took Hood back to Grandma's house, and found her grandma. Now they were safe and happy. The wolf was never seen again.

Syllable Circle Task

Total Score (___/12)

E - I am going to read a few sentences. You have to listen very carefully. After I finish each sentence, I am going to ask you to circle a sound with the pencil. For example, this says "He forgot to bring his book". If I ask you to circle "got ", you circle here.

1. This garden is pretty (noun, 2+).
2. They are running (verb , 2+).
3. They enjoy dancing (verb, 2+).
4. Bruce sat on the chair (verb, 1).
5. John went to school (verb, 1).
6. The ball rolled off the table (functor, 1).
7. Mary's home is very big (noun, 1).
8. The glass is on the table (functor, 1).
9. The red bird flew away (noun, 1).
10. We watched a football game (noun, 2+).
11. Wash before you eat (functor, 2).
12. The balloon is over the tree (functor, 2).

Syllable Cover - Same Language

E - I am going to read you something written on this paper. Then, I am going to cover up part of it, and I want you to tell me what the rest of it says. This says: "three pretty deer." "What does it say?" (when the subject responds correctly) Cover up the first syllable.

Syllable Mismatch/Word Match

Total Score (__/3)

~~Three~~ pretty deer (cover one)

~~Three pret~~ty deer (cover two).

~~Three pretty~~ deer (cover three).

Syllable Match/Word Mismatch

Total Score (__/3)

~~Four~~ dirty mice (cover one)

~~Four dirt~~y mice (cover two).

~~Four dirty~~ mice (cover three).

Syllable Cover - Other Language

Total Score (___/6)

(Same task as above except that Chinese writing is used)

Appendix C: Task Order Lists for Study 2

LIST 1

Session 1: Word Repetition - List; Word Repetition - Story; Word Circle; Word Cover

Session 2: Syllable Repetition - List; Syllable Repetition - Story; Syllable Circle; Syllable Cover

LIST 2

Session 1: Word Circle; Word Cover; Word Repetition - List; Word Repetition - Story

Session 2: Syllable Circle; Syllable Cover; Syllable Repetition - List; Syllable Repetition - Story

LIST 3

Session 1: Syllable Repetition - List; Syllable Repetition - Story; Syllable Circle; Syllable Cover

Session 2: Word Repetition - List; Word Repetition - Story; Word Circle; Word Cover

LIST 4

Session 1: Syllable Circle; Syllable Cover; Syllable Repetition - List; Syllable Repetition - Story

Session 2: Word Circle; Word Cover; Word Repetition - List; Word Repetition - Story

Appendix D: Statistical Analyses of Control Variables in Study 2

Source	df	F
For Dependent Variable = Word - Text Tasks		
Sex	1	.02
List	3	2.44
Age Group	2	90.53***
Culture/Script	1	3.68
For Dependent Variable = Character/Syllable - Text Tasks		
Sex	1	.00
List	3	.12
Age Group	2	81.94***
Culture/Script	1	11.19**
For Dependent Variable = Word - Speech Tasks		
Sex	1	.49
List	3	2.09
Age Group	2	46.82***
Culture/Script	1	7.17**
For Dependent Variable = Character/Syllable - Speech Tasks		
Sex	1	.06
List	3	1.48
Age Group	2	42.19***
Culture/Script	1	82.75***

Note. **$p < .01$ ***$p < .001$