The Relation Between Metalinguistic Ability, Social Metacognition and Reading: A Developmental Study

Claire Fletcher-Flinn
Department of Psychology, University of Auckland

Heidi Snelson
Department of Psychology, Victoria University of Wellington

This study examined the relation between metalinguistic ability, social metacognition, linguistic and general ability prior to the commencement of reading and 6 months after school entry. Forty-eight children between the ages of 4.3 and 4.9 years from several preschools in Wellington, New Zealand participated in the first part of this study and 42 were subsequently retested one year later. Children were administered the block design and vocabulary subtests from the WIPPSI, a test of print awareness, a rhyme task, a syllable segmentation task, and a false-belief task in two separate 20-minute sessions at the preschool. The Burt Word Reading Test, and a phonemic segmentation task were also included at retesting. Results showed, on the whole, a pattern of significant relationships among various meta-abilities at preschool and that most were correlated with general ability. One year later, with the advent of reading instruction, only phonemic segmentation and print awareness were significantly related. The best predictor of later reading achievement was syllable segmentation taken at preschool, while contemporaneous correlates were measures of phonemic segmentation and print awareness. These results support a view of the development of metacognition that is domain-general and based on an underlying cognitive capacity. Particular rather than general metalinguistic abilities are related to reading ability, and these change over time.

At least since the 1980s, the development of children's thought has been strongly influenced by concepts of "modularity", that is, the mind is best conceived as a loosely connected set of specialised modules. This view has had the effect of restricting developmental research to particular domains because it was not thought that change would occur in parallel across modules. More recently, Case et al. (1996) have presented substantial evidence to the contrary, and have argued strongly for the role of central conceptual structures and domain-general shifts in development. A similar view has been expressed with regard to representational abilities in children. 'Metamind' is a term which has been coined to describe the general shift in (meta) representational functioning that occurs around the age of four years in children's thinking about self, others, and objects (Suddendorf, in press). It seems timely, then, to consider a long-standing debate about the relationship among a number of separate meta-abilities comprising metacognition, and how this relationship changes over time. Metacognition is generally thought of as an introspective awareness, combined with an active monitoring and planful regulation (or control), of cognitive states and their operations.

The main point of controversy in this area is over the status and role of metalinguistic ability (or metalinguistic awareness), which refers specifically to the reflection on and manipulation of the structural characteristics of language. Metalinguistic ability has been viewed as separate from the other meta-abilities, linked only by a set of skills which are a result of the general development of consciousness (Gleitman, Gleitman, & Shipley, 1972). Donaldson (1978) has suggested that metalinguistic ability, which she claims is triggered by the onset of formal reading instruction, is largely responsible for the development of an awareness of thought, which serves as a catalyst for the development of the other meta-abilities and ultimately cognition itself. In contrast, other theorists (e.g., Flavell, 1976; 1978; 1981; Flavell & Wellman, 1977) have not allocated any special role to metalinguistic ability and place it within the general area of metacognition. In their view,

metalinguistic ability, is but one of a number of 'meta-abilities' which emerge during middle childhood along with metalearning, meta-attention, metamemory and social metacognition or 'theory of mind'. Flavell and Wellman (1977) have suggested, however, that the meta-abilities which are related to external objects such as self and others are more accessible to perceptual inspection and hence become available as objects of knowledge earlier than other meta-abilities, such as metamemory, which are less overt.

The dynamics of metalinguistic development also reflect these particular views. Tunmer and Herriman (1984) outlined two major conceptions of the emergence and growth of metalinguistic ability. The first suggests that metalinguistic ability develops concomitantly with language acquisition (e.g. Clark, 1978; Clark & Andersen, 1979; Marshall & Morton, 1978) and is based on observations of young children's spontaneous speech repairs. However, many theorists believe that this form of metalinguistic ability is better characterised as epilinguistic (without conscious monitoring) in nature (Gombert, 1992; Tunmer & Herriman, 1984), therefore, it will not be considered further. The second view is more directly of interest. It is claimed that metalinguistic abilities develop from early to middle childhood (4-8 years) either as a result of some underlying change in cognitive capabilities and related to the emergence of concrete operational thought, or via the mediating influence of a third factor, namely, learning to read. In support of the central structures explanation, correlations have been found between tests of concrete operations and metalinguistic awareness (Hakes, Evans, & Tunmer, 1980). However, Donaldson (1978) has argued strongly that learning to read, which requires attention to more formal aspects of language and orthography such as sounds and letters, words, and syntax, triggers certain metalinguistic functions. Although positive and strong correlations between metalinguistic abilities and reading proficiency are abundant, other data suggest that metalinguistic awareness is a prerequisite for learning to read (e.g., Backman, Bruck, Hebert, & Seidenberg, 1984; Olofsson & Lundberg, 1985; Tunmer & Nesdale, 1985). It is these latter correlates which have led many authors to subscribe to a bidirectional view, with metalinguistic ability seen as both a prerequisite for learning to read as well as a consequence of reading, (see Tunmer, 1991 for a review of this area).

There are a wide variety of metalinguistic abilities and tasks which measure them. With regard to literacy acquisition, the appreciation of rhyme, syllable and phoneme segmentation, and an awareness of print are just some of the abilities that have been found to be associated with reading ability. Although tests of these abilities are in common use, they derive from different research paradigms and are not generally used in combination, so it is not clear how they relate to each other.

Much of the early work on syllabic identification has been concerned with children's early acquired rhyme identification. While it has been proposed that rhyming ability requires a segmental analysis of onset and that rhyme and can help bridge the gap to an awareness of phonemes (Bradley & Bryant, 1983; Goswami & Bryant, 1990; Treiman & Zukowski, 1991), opponents suggest that rhyming ability reflects a nonsegmental awareness which serves as an aid only for orienting the child's attention to speech structure (Content, 1985 cited in Gombert, 1992; Morais, 1991). Rhyming has not been found to correlate with tests of other metaphonological abilities, in preliterate children (Yopp, 1988) or normal, dyslexic and illiterate adults (Content, Morais, Kolinsky, Bertelson, & Alegria, 1986), nor does it predict reading achievement (Lundberg, Frost, & Petersen, 1988; Stanovich, Cunningham, & Cramer, 1984).

A syllabic awareness task which does seem to require a segmental analysis is one devised by Liberman, Shankweiler, Fisher, & Carter (1974) which requires children to repeat multisyllabic words and then to tap the number of syllables heard in each word. Using a criterion of six successive correct answers, the rate of success was 46 percent in 5-year-olds, 48 percent in 6-year-olds and 90 percent in 7-year olds. Phonemic segmentation appears to be more difficult than syllable segmentation and is later to develop. For example, the success rate for phoneme tapping for the 5, 6 and 7-year-old children in the Liberman et al. study (1974) was respectively zero, 17 percent and 70 percent. There is ample correlational evidence from studies of both normal and dyslexic children that metaphonological ability is related to reading (for recent reviews, see Gombert, 1992; Goswami & Bryant, 1990; Wagner & Torgesen, 1987), and some authors have suggested that not only is reading a trigger for phonological awareness to develop but it may require explicit teaching instruction using a phonic method for success (Morais, 1991). However, Thompson and Fletcher-Flinn (1993), and Thompson, Cottrell, and Fletcher-Flinn (1996) have shown that 5-year-old children learning to read via a whole-word method could induce grapheme to phoneme relationships through their lexical experience alone.

Research on early conceptions of written language including knowledge of the general characteristics and objectives of writing and graphemic or print awareness have demonstrated that even before formal reading instruction begins children have awareness of some of the main conventions that apply to the written word, such as holding a book correctly, naming some letters, and recognising words in context (Gombert, 1992). Knowledge of these print characteristics have been implicated as a factor which makes it easier for children to learn to read (Clay, 1979). Both Day and Day (1981) and Kontos (1983) found that lower levels of print awareness such as knowing where to look on a page, identifying letters and words, noticing print inversions, and line/letter reversals were good predictors of early reading skills, whereas according to Kontos (1983) conceptual knowledge that print represents language and its meaning was a consequence of print-related experiences. Print awareness could therefore be considered reciprocally related to reading, that is, some aspects of print awareness are precursors of reading, and further development results from instruction.

The hallmark of any meta-ability is that of cognitive control (i.e., executive processing). This is evident in the segmentation tasks, for example, by the slow, attention-consuming activities that involve deliberate reflection on,

and manipulation of, the structural features of spoken language, as opposed to the 'automatic' processing of normal language for comprehension. Children's social thinking, as demonstrated in theory of mind (ToM) tasks, is also purported to have an element of control. ToM, which is the ability to impute mental states to oneself and others and use this facility to predict behaviour, has been the focus of much research over the past decade in developmental psychology. Tests of strategic deception and false-belief tasks have been used to measure children's mentalising capacities. The false-belief tasks are all variants of the standard change-in-location paradigm and are acted out with toys (Wimmer & Perner, 1983). For example, a girl doll named Sally has a marble and puts it in a box then goes away. While she is gone, Anne takes it out and puts it away in her basket. Then Sally returns and wants to play with her marble. The child is asked where Sally will look for it. Two additional control questions are given to check that the child understands where the marble was originally placed and its current location. In strategic deception tasks the child is faced with two boxes, one of which is empty, the other containing an attractive object. The task is to instruct the opponent to search in the empty box by pointing (Russell, Jarrold, & Potel, 1994). The mentalising component in both ToM tasks is to consider the informational state or belief of the protagonist (or opponent) and the performance consequences.

It is well documented that by the age of 4 years children can usually pass such tests, although failing when younger (Leslie, 1987; Perner, Leekham, & Wimmer, 1987; Russel, Mauthner, Sharpe, & Tidswell, 1991; Sodian, 1991; Wellman, 1990). Explanations for the failure of these young children, as well as autistic children (Baron-Cohen, Leslie, & Frith, 1985; Russel et al., 1991), have included the metarepresentational (Leslie, 1987) or cognitive (Perner, 1991) nature of the mentalising ability needed. Others have pointed to the heavy demand made on children's language skills by the standard tasks (Lewis & Osborne, 1990; Prior, Dahlstrom, & Squires, 1990).

A third position offered by Russell et al. (1994) focuses on the cognitive requirements of deceptive behaviour. With regard to successful performance on tasks of strategic deception, they have suggested that two distinct skills - the 'metarepresentational' insight that false beliefs can be implanted in the minds of others, and executive control to suppress the truth while concurrently expressing a falsehood - are necessary. Likewise, it can be argued that these same two skills are necessary for standard false-belief tasks. The similarity in the mentalising component is obvious, and executive control would be needed to suppress the child's own knowledge about the current position of the object (reality) in order to indicate where the protagonist (who has a false-belief) will look for it.

In a series of studies in which these two components were manipulated, Russell et al. (1994) found evidence for an executive contribution to the 3- to 4-year transition in mental ability. Rather than an executive deficit assuming a masking function (that is, the children really had mentalising ability but it could not be revealed in this task), they concluded that it seemed more likely that it was the gaining of strategic control over the child's own mental acts through a developmental process that enabled the child to reflect upon mental categories. If this executive-maturation hypothesis is correct then that places tasks that fall into the realm of social metacognition, such as deception tasks, squarely on a par with other metacognitive or metalinguistic tasks by definition. However, there are no current data with a normal sample of young children to support this view.

Another reason why metalinguistic and ToM tasks may be related is that there is evidence that both are dependent on general language ability. Bowey and Patel (1988) statistically controlled for language and found that metalinguistic ability did not account for any unique variation in early reading achievement. This suggests that metalinguistic ability is not developmentally independent of language. Similarly, Jenkins and Astington (1996) found false-belief understanding to be associated with general language ability, even after the effect of age was partialed out.

The purpose of this study was to explore the relation between various measures of metalinguistic ability, social metacognition and general ability in four-year-old children prior to school entry and one year later after formal reading instruction had begun. The predictive ability of the early measures on reading achievement was a secondary aim. Because all of the metalinguistic abilities have been found to be related to reading, it was expected that these measures would be intercorrelated and be related to general ability at both ages. Because there are strong theoretical arguments for a control component in social metacognition, it was also expected that the false-belief task would correlate with the other metacognitive variables. If a relationship was found, then this would provide some support for a model of metacognitive ability in which various meta-abilities are related and suggest a central structure account.

The second part of this study involved re-testing the children 6 months after school entry when they were 5.5 years old. The reason for including the second wave of data was to examine the specific effects of maturation and social skills experience, in particular school entry and formal reading instruction, on the correlational pattern of meta-abilities at 5.5 compared with the earlier pattern. It was predicted that all metacognitive abilities would show improvement, and would remain interrelated if the central structure view is viable. Although various meta-abilities may be related, that does not mean that all are associated with reading ability. Therefore, a regression analysis using the 4.5 year-old scores was used to find the best predictors of early reading success.

Method

Subjects

Forty-eight children (25 girls, 23 boys) from five preschools in the Wellington area (New Zealand) participated in the initial phase of this study. All children were between the ages of 4.3 to 4.9 years (mean=4.6, sd=.16), and were unable to read as reported by the parents. (An informal assessment was also made by presenting each child with the reading assessment stimulus and asking if any words were known.) The children were drawn from preschools situated in mainly white middle-class suburbs.

Forty children were able to be re-tested when they reached 5.5 years; the other eight children had moved from the area and were unable to be contacted. Because children in New Zealand start school on their 5th birthday, the children would all have had an equivalent of 6 months of formal reading instruction with a language experience (whole-word) method. Primary emphasis is placed on the sounds of letters in the initial position of words as a cue to guessing unknown words in context, (see Thompson, 1993, for a review of this approach).

Materials

The block design subtest of the Weschler Primary and Preschool Scale of Intelligence (WIPPSI) (Weschler, 1967) and the British Picture Vocabulary Scale (BPVS) (Dunn, Dunn, & Whetton, 1982) were used to get a general nonverbal and verbal measure of ability, respectively. Metalinguistic ability was measured by a version of the rhyme-oddity task (Bradley & Bryant, 1983; Bryant, Bradley, Mclean, & Crossland, 1989), a syllable segmentation, and phoneme segmentation task (at 5.5 years only) (Liberman et al., 1974), and the Mow-Motorcycle Test (Rozin, Bressmann, & Taft, 1974) was used to test for print awareness. Social metacognition was assessed by a false-belief task, the Sally-Anne task (Prior et al., 1990), and reading achievement by the Burt Word Reading Test (Gilmore, Croft, & Reid, 1981) which is considered a measure of the child's word recognition skills.

The metalinguistic tasks were aurally presented and no materials were used except for a wooden dowel for tapping in the segmentation tasks, and a set of nine cards for the Mow-Motorcycle Test. On each 13 cm. by 20 cm. card was written two words (one consisting of one syllable and the other multisyllabic), one below the other and balanced for length of word position and target selection.

Two dolls, a white cardboard box with a lid, an oval-shaped basket with a lid, and a marble were used for the first trial on the Sally-Anne task. The dolls were identical except for hair colour. In the second trial the Examiner's pocket was used instead of the basket. The Burt Word Reading Test consisted of 110 words printed on a test card with easier words at the start and gradually increasing in difficulty.

Procedure

Each child was tested individually by the second author in a quiet room attached to the school. Testing was carried out in two 20-minute sessions when the children were 4.5 years-old and one session of the same duration a year later. The order of administration of the tests for the 4.5 year-old children was: the Sally-Anne task, the Mow-Motorcycle Test, the syllable segmentation task, and the BPVT for the first session. The block design and the rhyme task were given in the second session several days later. When the children were 5.5 years-old the order of administration was similar and consisted of the Sally-Anne task, the syllable segmentation task, the Mow-Motorcycle Test, the phonemic segmentation task, the Burt Word Reading Test, and the rhyme task. All of the tasks were given according to the instructions provided by the authors of the various experimental tasks, and the standard procedure for the administration and scoring of the BPVS and the block design was followed.

The one exception was on the segmentation tasks where no feedback was given on the test trials, and only the first 21 items were given instead of the 42 making up the original test. These changes were made in order to minimise the effect of lack of interest and concentration with young children who might find the tasks very difficult, particularly if they had to be corrected after each trial. It also kept the format more consistent with the other tests in which no feedback was given once the tests began.

The rhyme task consisted of 10 trials of four aurally-presented words (e.g., fan, cat, hat, mat). The child's task was to choose the odd one out. Before the trials began, the Examiner explained what was meant by a rhyme, and two practice trials were given. No picture cards were used in this version of the rhyme task, and no feedback was given as to whether the child's response was correct. Scoring was based on the number correct.

The syllable and phoneme segmentation tasks required the child to repeat a word or sound spoken by the Examiner, then to indicate by tapping with a wooden dowel, the number of segments in each word (syllables), or sound (phonemes). Training was carried out on four sets of items (trials) for each task separately. Testing commenced when the Examiner thought that the child had grasped the idea of what was required, that is, when most of the child's responses were correct, otherwise the practice trials were repeated. The test items consisted of 21 items in one, two, or three segments arranged randomly. Both the number of items correct and when the criterion of 6 successive correct trials was reached were noted.

The Mow-Motorcycle Test consisted of showing children pairs of words on a card of which one was multisyllabic (e.g., motorcycle) and the other consisted of one syllable (e.g., mow). Each pair was read aloud with the short word always read first. The child was asked to choose which spoken word corresponded to the printed words. Nine word pairs were administered with the first pair considered a training trial. Feedback about whether the response was correct was provided for the training trial only. Following the last trial the child was asked how he/she determined which spoken word matched the written words. Scores were the number of correct trials excluding the first.

The Sally-Anne task was narrated with appropriate actions. Two dolls were introduced to the child, Sally and Anne. With the child watching, the Examiner caused Sally to place a marble in her basket. Sally then left and while she was away Anne transferred the marble to her box. Sally then returned and the child was asked two questions: (1) "Where is the marble really?" (the reality question), (2) "Where was the marble in the beginning?" (the memory question). If the child could not answer these questions correctly, the sequence of actions was repeated until the child could respond correctly. The child was then asked (3) "Where will Sally look for the marble now?" (the belief question), and the memory and reality questions were asked again. The reality and memory questions asked initially

were considered control questions to ensure that the child had attended to the story and could remember where the marble was before and knew its current location. In order to provide a correct response for the third question the child must understand that someone else can hold a different belief to the belief the child holds, and, in this case, that (different) belief is false. This ability is thought to involve second-order or meta-representation. The reality and memory questions were repeated at the end of the game to ensure that the child was still able to remember the sequence of actions. The task was presented twice, but for the second trial Sally put the marble in the Examiner's pocket. The rest of the game format was retained. Scoring consisted of the number of memory, reality, and belief questions that were correct.

For the Burt Word Reading Test, the test card was presented to the child and the child was asked to read as many words as possible. No feedback was given about whether the response was correct. The child was encouraged to read until a criterion of ten consecutive words were failed, at which point the child was asked to scan the card to see if any others could be read. Scoring consisted of the number of correctly read words.

Results

Preschool children: 4.5 years

Raw scores for the block design subtest were transformed into scaled scores, and into IQ scores for the BPVS. The number of correct responses was calculated for the syllable and phoneme segmentation tests, the Mow-Motorcycle and the Sally-Anne tests. Separate scores for the Sally-Anne reality and memory questions were also calculated. Means and standard deviations are presented in Table 1.

A goodness of fit test was carried out separately on the number of correct responses on the syllable segmentation, rhyme, Sally-Anne and Mow-Motorcycle tests. The rationale behind this was that if the children were merely guessing on these tasks the resulting distribution of scores would resemble a binomial distribution. Taking the probability of a guess into consideration and combining small frequencies, the resulting Chisquared statistics showed that the children's scores were not likely to be due to chance for syllable segmentation, ($x^2_{(10)} = 1400.94$, $p < .001$), Sally-Anne, ($x^2_{(2)} = 36.791$, $p < .001$), or for the rhyme task, ($x^2_{(6)} = 32.58$, $p < .001$). In contrast, the children's performance on the Mow-Motorcycle Test ($x^2_{(8)} = 12.54$, $p < .15$) was at chance level, although an examination of individual scores provided no evidence of response bias. Most children - 90% - had no verbalizable awareness of how they chose an answer for the print awareness task.

Scores on the rhyme and Mow-Motorcycle tasks were low, while they were moderate on the syllable segmentation task with 67% of the children reaching criterion. The latter task, in particular, seemed to be characterised by a bimodal distribution with children either performing very well or very poorly. Performance on the reality questions for the Sally Anne task were all correct, and only a few children made errors on the memory questions, usually just mixing-up the doll's names. The distribution of scores was bimodal with roughly half of the children passing both trials and the other half failing both.

Spearman correlation coefficients were calculated for all pairs of variables including age, and these are presented in Table 2. Because the correlation between the number of trials to reach criterion on the syllable segmentation task and the number correct was high, ($r_s = .79$, $p < .001$), for ease of interpretation only the correlations for the latter are reported here. All of the variables were moderately but significantly related to block design except for performance on the Sally-Anne task. Likewise, performance on tasks representing the meta-abilities were significantly intercorrelated except for rhyme. Rhyme was associated with general intelligence by a significant but low correlation, and was marginally correlated with age and performance on the BPVS ($p = .06$) and the Mow-Motorcycle Test ($p = .07$). As well as being marginally correlated with rhyme, age was significantly correlated with most of the other variables except for verbal intelligence (BPVS) and the Sally-Anne task. The correlation between verbal intelligence and block design was significant and moderate, and significant and low between the BPVS and the Mow-Motorcycle Test.

Because general intelligence and age were correlated with so many of the meta-abilities and print awareness, another set of correlational analyses was done, partialling out the effect of age. All of the associations between the metalinguistic abilities and general intelligence held, so both age and intelligence were removed in a further set of analyses. The correlation between syllable segmentation and the Sally-Anne task remained stable ($r_s = .46$), as did the relation between rhyme and the Sally-Anne task ($r_s = .24$), which reached

Table 1

Means and standard deviations for all tests

	4½ years (n=48)			5½ years (n=40)	
	mean	sd		mean	sd
Block design	13.3	2.6		-	-
BPVS	98.3	9.5		-	-
Syllable segmentation (max 21)	15.8	4.5		19.2	2.5
Rhyme (max 10)	3.1	2.1		4.4	2.2
Mow-Motorcycle Test (max 8)	4.3	1.3		6.9	1.5
Sally-Anne (belief: max 2)	1.0	1.0		1.9	0.4
Sally-Anne (memory: max 2)	1.7	0.6		1.8	0.5
Sally-Anne (reality: max 2)	2.0	0.0		2.0	0.2
Phoneme segmentation (max 21)	-	-		8.9	3.4
Burt	-	-		11.4	8.4

Table 2
Spearman correlation coefficients for all tests

		1	2	3	4	5	6
1	Block Design	-					
2	BPVS	.39**	-				
3	Rhyme	.26*	.23	-			
4	Syllable Segmentation	.46***	.07	.17	-		
5	Mow-Motorcycle Test	.46***	.28*	.20	.39**	-	
6	Sally-Anne	.15	.19	.22	.46***	.35**	-
7	Age	.34**	.06	.23	.35**	.32**	.15

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

significance at the .05 level. However, the correlation between performance on the Mow-Motorcycle Test and syllable segmentation and the Mow-Motorcycle Test (r_s=.16) and Sally-Anne (r_s =.18) failed to reach significance.

Primary school children: 5.5 years

When the same children were tested at 5.5 years, significant improvement was shown on all tests: $t_{(40)} = 3.24$, $p < .002$ for rhyme, $t_{(40)} = 5.06$, $p < .001$ for syllable segmentation, $t_{(40)} = 9.29$, $p < .001$ for the Mow-Motorcycle Test, and $t_{(40)} = 6.66$, $p < .001$ for the Sally-Anne task. Criterion was reached by all of the children on the syllable segmentation task, although only 13% reached criterion for phonemes. A goodness-of-fit test performed on the number correct for the phoneme segmentation task showed that the children did better than chance ($x^2_{(10)} = 89.76$, $p < .001$), however, mean scores were still quite low. Performance on syllable segmentation, and the Sally-Anne and Mow-Motorcycle tasks were close to ceiling levels, and 85% of the children were able to explain the relation between a word's spoken and written length on the latter task. Scores on the rhyme task were moderate. Reading ages were in the appropriate range (5.1 - 5.07 years) given the age of the children.

Spearman correlation coefficients were calculated for all of the tests of meta-abilities, print awareness and reading (see Table 3). Considering only the meta-abilities, the phonemic segmentation task and the Mow-Motorcycle Test were significantly correlated. Others showed a weak pattern of nonsignificant correlation, including correlations between: syllable segmentation and phonemic segmentation; phonemic segmentation and rhyme; syllable segmentation and rhyme; the Mow-Motorcycle Test and syllable segmentation ($.06 < p < .10$). Likewise the Sally-Anne task and the Mow-Motorcycle Test were negatively but nonsignificantly related ($p < .10$).

Using all of the 4.5 year old variables, a stepwise multiple regression analysis was carried out on the data with the Burt as a dependent variable. Only 9% (adjusted) of the variance was accounted for by the syllable segmentation task, however, it was the only variable that was significantly correlated with the Burt ($r = .34$, $p < .03$). Age was negatively correlated ($r = -.23$, $p < .07$), while the other variables showed very little correlation at all, ($r = -.004$ for rhyme; $r = -.01$ for block design; $r = .11$ for BPVS; $r = -.06$ for Mow-Motorcycle; and $r = .15$ for Sally-Anne).

In relation to reading ability at 5.5 years (using just the 5.5-year-old measures) both the Mow-Motorcycle Test and phonemic segmentation were significantly related to the Burt, whereas syllable segmentation and the other meta-abilities showed little or no correlation.

Discussion

Although it is beyond the scope of this study to discuss the initial emergence of these various metalinguistic abilities, it does seem clear that by four and a half years of age and without any exposure to formal reading instruction, children in the present study did show some evidence of syllable awareness measured by either a rhyme or segmentation task. A smaller number of children had also developed some awareness of the relation between spoken and printed words. All of these metalinguistic abilities were related to general intelligence. Some measures, including rhyme and print awareness, were also related to verbal ability. The failure of syllable segmentation to correlate with verbal ability is consistent with the results of Tunmer, Herriman, and Nesdale (1988) who reported a similar finding using a phonological segmentation task. This suggests some degree of separation among the metalinguistic measures used. Although syllable segmentation and print awareness were associated, this relationship disappeared when general ability was controlled for. Rhyming ability was not related to either syllable segmentation or print awareness. This result is similar to other findings of no relationship between rhyme and syllable segmentation (e.g., Content et al., 1986; Yopp, 1988).

Previous explanations of these anomalies have focused on task parameters including content, characteristics and presentation. For example, it could be said that performance on our measures of verbal intelligence, rhyme and print awareness depended, in part, on some form of general word awareness. While performance on syllable segmentation presupposes word awareness, it also requires the ability to discriminate, segment and count constituent syllabic

Table 3
Spearman correlation coefficients for all tests at 5½ years

		1	2	3	4	5
1	Rhyme	-				
2	Syllable Segmentation	.24	-			
3	Mow-Motorcycle Test	.06	.23	-		
4	Sally-Anne	.03	.19	-.21	-	
5	Phonological Segmentation	.22	.23	.34*	.02	-
6	Burt	.18	-.01	.36*	-.14	.44**

* p<.05
** p<.01

elements within words. This additional requirement provides a possible explanation for the lack of a correlation between syllable segmentation and verbal ability. Another example of differing task requirements leading to the separation of various metalinguistic skills is the case of rhyming, which appears to be on the periphery of the broader net of metalinguistic associations, as it was unrelated to the other two metalinguistic measures. Although the ability to choose the word that doesn't rhyme from a set of words that do may well be a good measure of the child's sensitivity to the sound structure of spoken language and requires a reflective stance, it does not require segmentation skill as does the other syllable task used in this study, nor does it require the child to relate the sound structure of the word to a visual (orthographic) representation of it, as does the print awareness measure.

An alternative to a task factors explanation for the lack of relationships between various metalinguistic measures is variation in the emergence of these abilities. However, there is little supporting evidence for this interpretation as most of the children were able to perform all of the metalinguistic tasks except for print awareness. Good performance on this latter task may require at least some minimal exposure to print.

Turning to social metacognition, performance on the false-belief task was unexpectedly low for this age group, as other studies have shown that most 4-year-olds pass this task (e.g., Perner et al. 1987). It is not clear why so many of our sample did not. It was the first test presented to the children, so poor performance was unlikely to be related to tiredness or boredom. Moreover, the children were able to respond to the reality and memory control questions. Presumably, therefore, they were attentive and had followed the story line. Possible explanations may be unfamiliarity with a quiet, formalised (i.e., sitting down at a table with an unfamiliar adult) testing procedure with the result that some of the children might have been unsure about what was being asked of them, or some other type of cultural-experiential difference.

Curiously, false-belief was the only measure unrelated to general ability and language. The former result is also best explained by consideration of the task requirements. Both syllable and print awareness could be viewed as necessitating a reflective stance but, in addition, they also require the ability to solve problems similar to the one used to measure general intelligence. The false-belief task is more correctly classified as a perspective taking one with no additional component requiring such problem solving. The lack of an association with language is more difficult to explain, although it may have to do with the single vocabulary measure that was used in this study. Jenkins and Astington (1996) used a test measuring children's syntactic and semantic abilities in expressive and receptive form, as well as a sentence repetition task. They found that either was sufficient to take account of the effects of language on false-belief understanding.

Of primary interest, social metacognition was significantly related to both measures of syllable awareness when intelligence and age were controlled, but the relation with print awareness was lost. This pattern of relationships is difficult to explain given the previous discussion of the syllabic correlations. It was expected that syllable awareness would be correlated with the false-belief task because they are both purported to measure the control aspect of mentalising ability. However, rhyming ability and syllable segmentation were not related to each other. Therefore, their relation to the false-belief task must be based on some more general component such as an ability to dissociate and assume a reflective stance, irrespective of the stimuli, or general attentiveness. Overall, this pattern of relations prior to school entry seems to suggest both a conceptual relatedness as well as independence of various cognitive, metacognitive, and metalinguistic skills. It does provide some support for the central structure view in showing that meta-abilities comprising different domains are related.

By five and a half years performance had improved significantly on all of the meta-abilities. Similar to the pattern a year before, only the segmentation task (phonemic this time) and print awareness were significantly correlated. The metalinguistic abilities were characterised by a pattern of weak but nonsignificant relationships, while the false-belief task was unrelated to the other tasks. The lack of significant correlations is probably due to truncated range effects from ceiling levels having been reached on at least three of the tasks.

Looking specifically at reading acquisition, the best

predictor of reading achievement at five and a half years was syllable segmentation measured a year earlier. This result provides clear evidence for the independence of various metalinguistic skills (i.e. syllable segmentation and rhyming, print awareness), and social metacognition in terms of their impact on reading acquisition. This finding seems to be at odds with the interpretation of the data from a study by Morais, Cluytens and Alegria (1984), who found less of a difference between syllable segmentation for dyslexic readers than phonemic segmentation when compared with normal readers. However, their data actually do show a relation between reading ability and syllable segmentation - it is just not as strong as for phonemic segmentation. In addition, their sample was slightly older than the children in this study. Reading ability at five and a half years in this study was significantly correlated with both phonemic segmentation and print awareness. Surprisingly, there was only a weak trend for phoneme segmentation to be correlated with syllable segmentation, however, ceiling levels of performance had been reached on the latter. This result is more in accord with the Morais et al. (1984) conclusions.

Taken together, the results of this study seem to suggest a close relationship among various meta-abilities which appear during the preschool years and seem for the most part to be related to general ability. These relationships are dependent on the emergence of general meta-representational functioning, which is neccessary for successful performance on all meta-tasks. What underlies the emergence of this 'meta-mind' may be the changes in mental capacity (i.e., central conceptual structures) that Case et al. (1996) have suggested. That is, through interactive and dynamic learning processes, links are formed between the development of an understanding of the representational nature of mind with development occurring in other domains. It is thought that any conceptual lag within a domain can be mediated by more general (structural) understanding, which would contribute to a stuctural evenness within the whole cognitive system.

With the onset of formal schooling and reading instruction, performance is improved on all of the meta-tasks to ceiling levels in many cases, and the measured relations between them, therefore, are weakened. However, emergent metalinguistic abilities, that is, phonemic segmentation and print awareness, now become moderately associated.

When considering reading acquisition specifically, a shift is seen in the importance or usefulness of the metalinguistic skills that underpin successful reading performance. Prior to the onset of reading instruction, syllable segmentation is the best predictor of later reading achievement, but once reading begins it is more related to performance on phonemic segmentation and print awareness. Thus, an awareness of syllables and the ability to segment them may be an important early predictor of later reading success because it provides a good measure of the child's attention to speech structure. Once the child actually starts to read, this relationship becomes less important because reading depends, in addition, on an understanding of the alphabetic principle in terms of grapheme-phoneme correspondences, as well as general knowledge that spoken words can be represented in written form and there is a relation between the two. This explanation may account for the close association between phonemic segmentation and print awareness skills at five and a half years, and the developmental shift from syllabic to phonemic associations with the onset of reading. Both phonemic segmentation and print awareness may be more of an accompaniment to reading, with further development a result of reading rather than a 'strong' precursor for children who have not yet been exposed to print.

In summary, metacognitive development should be seen as a dynamic system reliant upon the state of underlying central conceptual structures. According to Case et al. (1996) these structures are best understood as networks of concepts and relations. As such, they undergo periodic and revolutionary change triggered by changes in information-processing capacity and children's social experiences. While change tends to occur across modules, this does not mean that certain modules cannot be directly affected by particular experiences. A good example is that metalinguistic segmentation ability appears to be related to the process of learning to read, whereas other metalinguistic and social thinking abilities are not.

References

Backman, J., Bruck, M., Hebert, M., & Seidenberg, M. S. (1984). Acquisition and use of spelling-sound correspondences in reading. *Journal of Experimental Child Psychology, 38*, 114-133.

Baron-Cohen, S., Leslie, A. M., & Frith, U. (1985). Does the autistic child have a 'theory of mind'? *Cognition, 21*, 37-46.

Bowey, J. A., & Patel, R. K. (1988). Metalinguistic ability and early reading achievement. *Applied Psycholinguistics, 9*, 367-383.

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

Bradley, L., & Bryant, P. E. (1985). *Rhyme and reason in reading and spelling.* Ann Arbor: University of Michigan Press.

Bryant, P. E., Bradley, L., MacLean, M., & Crossland, J. (1989). Nursery rhymes, phonological skills and reading. *Journal of Child Language, 16*, 407-428.

Case, R., Okamoto, Y., Griffin, S., McKeough, A., Bleiker, C., Henderson, B., & Stephenson, K. M. (1996). The role of central conceptual structures in the development of children's thought. *Monographs of the Society for Research in Child Development, 61* (1-2, Serial No. 246).

Clark, E. V. (1978). Awareness of language: Some evidence from what children say and do. In A. Sinclair, R. J. Jarvella and W.J.M. Levelt (Eds.). *The child's conception of language.* Berlin:Springer-Verlag.

Clark, E. V., & Andersen, E. S. (1979). *Spontaneous repairs: Awareness in the process of acquiring language.* Paper presented at Symposium on Reflections on Metacognition, Society for Research in Child Development, San Francisco.

Clay, M. M. (1979). *Reading: The patterning of complex behaviour.* Auckland, N.Z.: Heinemann Educational Books.

Content, A., Morais, J., Kolinsky, R., Bertelson, P., & Alegria, J. (1986). Explicit speech-segmentation ability and susceptibility to phonological similarity in short-term retention: No correlation. *Perceptual and Motor Skills, 63*, 81-82.

Day, K. C., & Day, H. D. (1981). The development of orthographic linguistic awareness in kindergarten children and the relationship of this awareness to later reading achievement. *Reading Psychology, 2*, 76-87.

Donaldson, M. (1978). *Children's minds.* Glasgow: Collins.

Dunn, L. M., Dunn, L. M., & Whetton, C. (1982). *British Picture Vocabulary Scale.* Berkshire, England: NFER-Nelson.

Flavell, J. H. (1976). Metalinguistic aspects of problem solving. In B. Resnick (Ed.), *The nature of intelligence*. Hillsdale, N. J.: Erlbaum.

Flavell, J. H. (1978). Metacognitive development. In J. M. Scandura and C. J. Brainerd (Eds.), *Structural/process models of complex human behaviour*. Alphen an den Rijn, the Netherlands: Sijthoff and Noordhoff.

Flavell, J. H. (1981). Cognitive monitoring. In W. P. Dickson (Ed.), *Children's oral communication skills*. New York: Academic Press.

Flavell, J. H., & Wellman, H. M. (1977). Metamemory. In R. V. Kail, Jr. and J. W. Hagen (Eds.), *Perspectives on the development of memory and cognition*. Hillsdale, N. J.: Erlbaum

Gilmore, A., Croft, C., & Reid, N. (1981). *Burt Word Reading Test: New Zealand Revision*. New Zealand Council for Educational Research, Wellington, New Zealand.

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

Gombert, J. E. (1992). *Metalinguistic development*. Hemel Hempstead: Harvester Wheatsheaf.

Goswami, U., & Bryant, P. E. (1990). *Phonological skills and learning to read*. Hove, U.K.: Lawrence Erlbaum Assoc. Ltd.

Hakes, D. T., Evans, J. S., & Tunmer, W. E. (1980). *The development of metalinguistic abilities in children*. New York: Springer-Verlag.

Jenkins, J. M., & Astington, J. W. (1996). Cognitive factors and family structure associated with theory of mind development in young children. *Developmental Psychology, 32*, 70-78.

Kontos, S. (1983). *The development and function of print awareness*. Paper presented at the Society for Research in Child Development, Detroit, U.S.A.

Leslie, A. M. (1987). Pretense and representation: The origins of 'theory of mind'. *Psychological Review, 94*, 412-426.

Lewis, C., & Osborne, A. (1990). Three-year-olds' problems with false belief: Conceptual deficit or linguistic artefact? *Child Development, 61*, 1514-1519.

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

Lundberg, I., Frost, J., & Petersen, O.- P. (1988). Effects of an extensive programme for stimulating phonological awareness in preschool children. *Reading Research Quarterly, 23*, 267-284.

Marshall, J. C., & Morton, J. (1978). On the mechanics of EMMA. In A. Sinclair, R. Jarvella, and W. J. M. Levelt (Eds.), *The child's conception of language*. Berlin: Springer-Verlag.

Morais, J. (1991). Constraints on the development of phonemic awareness. In S. A. Brady, and D. P. Shankweiler (Eds.), *Phonological processes in literacy: A tribute to Isabelle Y. Liberman*. New Jersey: Lawrence Erlbaum Assoc.

Morais, J., Cluytens, M., & Alegria, J. (1984). Segmentation abilities of dyslexics and normal readers. *Perceptual and Motor Skills, 58*, 221-222.

Olofsson, A., & Lundberg, I. (1985). Evaluation of long-term effects of phonemic awareness training in kindergarten. *Scandinavian Journal of Psychology, 26*, 21-34.

Perner, J. (1991). *Understanding the representational mind*. Cambridge, MA, MIT Press.

Perner, J., Leekham, S. R., & Wimmer, H. (1987). Three-year-olds' difficulty with false belief: The case for a conceptual deficit. *British Journal of Developmental Psychology, 5*, 125-137.

Prior, M., Dahlstrom, B., & Squires, T.- L. (1990). Autistic children's knowledge of thinking and feeling states in other people. *Journal of Child Psychology and Psychiatry and Allied Disciplines, 31*, 587-601.

Rozin, P., Bressman, B., & Taft, M. (1974). Do children understand the basic relationship between reading and writing? The Mow-Motorcycle test. *Journal of Reading Behavior, 1*, 327-334.

Russell, J., Jarrold, C., & Potel, D. (1994). What makes strategic deception difficult for children — the deception or the strategy? *British Journal of Developmental Psychology, 12*, 301-314.

Russell, J., Mauthner, N., Sharpe, S., & Tidswell, T. (1991). The 'windows task' as a measure of strategic deception in preschoolers and autistic subjects. *British Journal of Developmental Psychology, 9*, 331-349.

Sodian, B. (1991). The development of deception in young children. *British Journal of Developmental Psychology, 9*, 173-188.

Stanovich, K. E., Cunningham, A. E., & Cramer, B. R. (1984). Assessing phonological awareness in kindergarten children: Issues of task comparability. *Journal of Experimental Child Psychology, 38*, 175-190.

Suddendorf, T. (in press). The rise of metamind: Beyond the immediately present. In M. C. Corballis and S. Lea (Eds.), *Evolution of the hominid mind*. Oxford: Oxford University Press.

Thompson, G. B. (1993). Appendix: Reading instruction for the initial years in New Zealand Schools. In G. B. Thompson, W. E. Tunmer, and T. Nicholson (Eds.), *Reading acquisition processes*. Avon, UK: Multilingual Matters.

Thompson, G. B., Cottrell, D. S., & Fletcher-Flinn, C. M. (1996). Sublexical orthographic-phonological relations early in the acquisition of reading: The knowledge sources account. *Journal of Experimental Child Psychology, 62*, 190-222.

Thompson, G. B., & Fletcher-Flinn, C. M. (1993). A theory of knowledge sources and procedures for reading acquisition. In G. B. Thompson, W. E. Tunmer, and T. Nicholson (Eds.), *Reading acquisition processes*. Avon, UK: Multilingual Matters.

Treiman, R., & Zukowski, A. (1991). Levels of phonological awareness. In S. A. Brady, and D. P. Shankweiler (Eds.), *Phonological processes in literacy: A tribute to Isabelle Y. Liberman*. New Jersey: Lawrence Erlbaum Assoc.

Tunmer, W. E. (1991). Phonological awareness and literacy acquisition. In L. Rieben and C. Perfetti (Eds.), *Learning to read: Basic research and its implications*. Hillsdale N. J.: Lawrence Erlbaum Associates.

Tunmer, W. E., & Herriman, M. L. (1984). The development of metalinguistic awareness: A conceptual overview. In W. E. Tunmer, C. Pratt, and M. L. Herriman (Eds.), *Metalinguistic awareness in children*. Berlin: Springer-Verlag.

Tunmer, W. E., Herriman, M. L., & Nesdale, A. R. (1988). Metalinguistic abilities and beginning reading. *Reading Research Quarterly, 23*, 134-158.

Tunmer, W. E., & Nesdale, A. R. (1985). Phonemic segmentation skill and beginning reading. *Journal of Educational Psychology, 77*, 417-427.

Wagner, R. K., & Torgesen, J. K. (1987). The nature of phonological processing and its causal role in the acquisition of reading skills. *Psychological Bulletin, 101*, 192-212.

Wellman, H. (1990). *The child's theory of mind*. Cambridge, MA: MIT Press.

Weschler, D. (1967). Weschler Preschool and Primary Scale of Intelligence. New York: The Psychological Corporation.

Wimmer, H., & Perner, J. (1983). Beliefs about beliefs: Representation and constraining function of wrong beliefs in young children's understanding of deception. *Cognition, 13*, 103-128.

Yopp, H. K. (1988). The validity and reliability of phonemic awareness tests. *Reading Research Quarterly, 23*, 159-177.

Acknowledgments

We thank the parents, children, and teachers of the kindergartens and primary schools in Newlands, Paparangi, and Johnsonville, New Zealand, for their participation and support in this research project. We also thank Bill Flinn and anonymous reviewers for their valuable comments.

Address for correspondence:

Dr Claire M Fletcher-Flinn
Dept of Psychology
University of Auckland
Private Bag 92019
Auckland, New Zealand
email: cm.fletcher-flinn@auckland.ac.nz