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Language in the context of motor activity: Gross and fine motor differences.

Theresa E. Morris
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Language in the Context of Motor Activity:
Gross and Fine Motor Differences

by

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A Thesis
Submitted to the Faculty of Graduate Studies
through the Department of Psychology
in Partial Fulfilment of the
Requirements for the Degree
of Master of Arts at the
University of Windsor
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1990
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ABSTRACT

The present study tested a portion of McCabe's (1989) model which predicts that a child's level of motor development may influence speech produced by both parents and child and subsequently the language acquisition style the child will develop. Subjects were eight boys and eight girls, and their mothers. Mothers were given the Motor Skills Domain of the Vineland Behavior Adaptive Scales to measure the child's current motor ability. Two out of three children who were at higher levels of motor development and lower levels of language development used an expressive style of speech. It was suggested that measures other than MLU be used to determine linguistic maturity due to characteristics of the expressive style. Contexts of gross and fine-motor activity were also created to see if different motor activity produces different speech. Context influenced types of speech produced in both mother and child, although not always in accompaniment. When responding to their mothers' speech, children did not respond to object labels to the same degree as their mothers had produced them. Motor development is a contextual influence on language development and children appear to contribute independently to the language-learning context. However, interaction of parent, child, and context appears to be even more subtle and indirect than McCabe's model proposes.
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CHAPTER I

INTRODUCTION

The present study was designed to examine the relationship between individual differences in motor and language development. As any parent knows, motor development is a highly salient aspect of the child's first two years; it is often used as a "benchmark" to determine whether one's child is progressing normally. As well, as the child becomes more motorically competent, the parent often notices and/or expects changes in the child's competence in general, no doubt behaving differently towards the child as a result. Surprisingly, little research has been conducted on the specific relation between motor development and language acquisition, another highly salient aspect of the child's first two years.

However, language acquisition in children has been the subject of developmental research for many years. Of particular interest in this study is the presence of individual differences in the language acquisition process. Over the past 15 years, this topic has gradually become a widely researched area. However, this has occurred only because of a gradual shift in focus from an emphasis on universal principles of language acquisition to what had
originally been considered error variance, that is, individual differences in the language learning process. A discussion of this shift will help to elucidate how individual differences in language acquisition came to attract the level of interest it has today.

Research in language development in the 1960's was greatly influenced by Chomsky's (1964) proposal that any theory of language acquisition should include a discussion of what has to be learned. There was a great emphasis on analyzing the syntax (i.e., the grammar) of children's speech (Wells, 1980). Children were seen to move from a stage of single word utterances, to two word utterances, to so-called "telegraphic speech." At this stage, children's sentences were like those found in telegrams, so it was postulated that children leave out words to create these shorter sentences. This theory has since gone out of favour, leaving "telegraphic speech" as a purely descriptive term. Children at this stage were said to strictly adhere to word order and acquire grammatical morphemes (e.g., "s", "ing") in a fixed sequence (Brown, 1973). By age five, children are sophisticated in their performance knowledge of grammar; while they may not understand why something is grammatically correct, they recognize grammatically correct language (Berko Gleason, 1985). Because this monumental task is accomplished in such a short time, it was assumed that universal aspects of
language must be innate, and therefore, that the course of development was also universal (Wells, 1980).

In 1970, Lois Bloom shifted the emphasis of the study of child language by introducing the idea that children's speech should undergo a rich interpretation; that is, investigators should consider not only the syntax, but also the meaning of the words as determined by their context. At the same time, the general approach to describing language was to describe the grammar of the child's sentences; single-word utterances were considered irrelevant unless they could be interpreted as a sentence. Consequently, two-word utterances, being considered sentences, garnered much interest at the expense of study of the single-word stage (Nelson, 1981).

Because language development was still considered to be a universal phenomenon, most individual differences were ignored. In fact, children who did not fit the typical course of language acquisition were generally excluded as subjects of study. The only individual differences in language acquisition that were recognized were speed and age of acquisition. However, in the early 1970's, a few psycholinguists who had studied the single-word period began to discover consistent individual differences in the acquisition of language in children (Bloom, 1973, Dore, 1974, Nelson, 1973, Peters, 1977). Instead of dismissing these variations as error, these researchers thought that such individual differences were phenomena worth discussing.
Two Styles of Language Acquisition

The individual differences in question take the form of two distinct styles of language acquisition and have been referred to in various ways; as nominal and pronominal (Bloom, 1973), referential and expressive (Nelson, 1973), analytic and gestalt (Peters, 1977), code-oriented and message-oriented (Dore, 1974), and noun-lovers and noun-leavers (Morgan, 1980). The different labels describe essentially similar styles which will be described below. The terms "referential" and "expressive" have been used most often in the literature, and therefore will be used here. Nelson (1973) stated that children do not necessarily use one style exclusively; most would be on a continuum between the two extremes. In support of this, Goldfield (1987) recently characterized most children as using a combination of the two styles.

A referential style of language acquisition is characterized mainly by a predominance of common nouns in the one-word stage, and tends to follow the typical pattern of development from one-word to two-word utterances to telegraphic speech, at which time pronoun use increases and noun use decreases (Nelson, 1975). Children adopting this style have a faster rate of vocabulary acquisition (Nelson, 1981) and seem to view language with a strongly semantic, lexical bent (Nelson, 1973); the function of language is to describe the physical world around them, therefore, words are used to represent concepts, not as things that can be
manipulated or played with (Dore, 1974, Nelson, 1973).

A substantial minority of children adopt a different style of language acquisition. Their early words have a predominance of pronouns and unanalyzed phrases (e.g., "go-bye-bye", "have-a-good-day, and "see-you-later") (Horgan, 1978, Nelson, 1973). Their speech includes many pivot words, such as "allgone", that can be combined with many other words to make new sentences. Peters (1977) suggests that the expressive child does not progress regularly from one word to two and so on but instead is interested in sentences from the very beginning. This can be seen in the inclusion of dummy and empty forms in early speech (Ramer, 1976). A dummy form is a single phonetic unit, not a word, extending an utterance (e.g., [ə-ball]) and has no semantic content. Empty forms are a stable group of phonetic elements grouped with a traditional word and, like the "dummy" form, are combined with many words. These function as fillers presumably in order to maintain the contours of sentences.

Horgan (1978, 1980, 1981) proposes that the expressive child’s interest in language is not as a tool for describing the world, but as a topic of interest in itself. For instance, her daughter, Kelly, made many early jokes based on twists on her present linguistic knowledge (Horgan, 1981). Additionally, Kelly’s questions were typically concerned with form, not content (Horgan, 1978). For example, she often answered a "yes-no" question, even when she did not comprehend
the question. This implies she was not concentrating on the content, but rather on the form. She also answered "wh-" and "yes-no" questions differently. For example, "Do you know what color this is?" and "What color is this?" would elicit different answers from Kelly. These questions have the same illocutionary force, but differ in locutionary force; they are used to get the same information but have different forms which technically require different answers.

Dore (1974) called his message-oriented (i.e., expressive) child an intonation baby because the child appeared to be focusing on the sound of the sentence more than the actual meaning in it. As well, this child exhibited many more prosodic speech acts (sounds that could not be identified as known words but appeared to have consistent meaning) than the code-oriented (i.e., referential) or word baby and these speech acts were produced more often than the other child's words. Finally, the expressive-style child appears to use language in more of a personal-social way. For instance, in Dore's intonation and word babies, 63% of the intonation baby's speech acts involved other people, as compared to 26% of the word baby's, and more than 50% had a direct influence on others compared to 14% of the word baby's (Dore, 1974). Dore concludes that the intonation baby was using language to manipulate other people. Nelson (1973) also proposes that the expressive children in her study view the function of language as a means of establishing and maintaining social contact.
Although the percentage use of nouns and pronouns in later stages of acquisition tends to converge in the speech of expressive and referential children (Nelson, 1975), there are continued differences in style. For example, expressive children tend to use a greater number of possessives, but fewer descriptive adjectives than referential children; they are not as interested in properties of objects as they are in objects as they relate to others, in keeping with their personal-social bias (Nelson, 1976). Morgan (1980) has traced differences in noun-lovers and noun-leavers up to age 14 and found differences continuing throughout the school years in such things as use of noun phrases and passive sentences. For example, lovers tend to be able to describe an object in one noun phrase; leavers do not use noun phrases as succinctly. A noun lover might say "It's a big, red circle."; a noun leaver would use two phrases, such as "It's square and it's red." The word order of leavers' early reversible passives was often wrong, that is, they produced syntactically but not semantically correct passives; again, an apparent concentration on form versus content. In the later use of passives, lovers tended to use non-reversible instrumental passives (e.g., "The lamp was broken by the ball") with longer noun phrases and more noun phrases per utterance. Leavers used more reversible passives (e.g., "The girl was chased by the dog.") with shorter noun phrases and generally fewer noun phrases per utterance.
There are other linguistic features that correlate with these stylistic differences. Expressive children tend to have poor articulation (Nelson, 1973, 1975, 1981, Peters, 1977), and they tend to have a slower rate of vocabulary acquisition (Nelson, 1973, 1975, 1981).


Theories to Explain the Presence of Different Acquisition Styles

Because these individual differences in style were being consistently observed in language studies, researchers could no longer assume that language acquisition was the unfolding of innate, universal principles. Differences must lie in the language-learning environment that would contribute to the development of referential or expressive speech. Parental speech to the child, particularly mother’s speech, was considered to be a likely contributor. Unfortunately, the evidence has been conflicting. This appears to be due to the fact that there is a difference between the syntactic and pragmatic influences of mother’s speech.
Masur (1982) found that mother's provision of names of objects when a child pointed wordlessly at the object was significantly associated with both the number of different object-labelling words used by the child accompanying pointing and number of different object names in the children's total lexicon. Nelson (1973) concludes that the language environment (i.e., what grammar/syntax the parent is using) does not importantly affect the child's use of language strategies. For instance, Furrow and Nelson (1984) found that mothers of referential and expressive stylists did not differ in number of nouns and pronouns used; instead, as referential children came to use more pronouns, the mothers used fewer object references and more person references than before and as expressive children got older, their mothers showed a decline in proportion of person references and an increase in object references. They could not make a causal argument however, because this could easily be interpreted as the mother "tuning in to" the child's speech; perhaps the mother heard her child using more object references, so she in turn used more object references.

On the other hand, pragmatic differences have been found in mother's speech to referential and expressive children. While Nelson (1973) did not report any, other researchers have. Dore (1974) found that his word baby engaged in many word-labelling games with his mother; the intonation baby did not. Della Corte, Benedict and Klein (1983) found that
parents' use of directives was associated with an expressive style and more questions and greater quantities of speech were associated with a referential style. As well, Lieven (1978) compared speech of mothers of an expressive and a referential child. She found that the expressive child's mother tended to not respond to her and when she did, it was not in a way as to extend conversation. The referential child’s mother, on the other hand, was very responsive and expanded consistently on her child's utterances (Lieven, 1978).

It may be too simplistic to assume that it is only the parent’s speech to the child which is affecting the linguistic interaction. Many researchers (e.g., Goldfield, 1987, Nelson, 1973, Ringler, 1978) suggest that characteristics of the child and/or his/her speech are probably affecting the parent’s speech which consequently affects child’s speech. As well, Nelson (1973) proposes a cognitive explanation for the existence of different linguistic styles. She suggests that children develop hypotheses as to the function that language is to serve and this in turn affects the vocabulary they choose to produce. One function is to describe the world of objects; the other is to use language in a personal-social way to interact with others.

Peters (1983) cites four factors contributing to individual differences: the individual make-up (e.g., temperament and cognitive style), the type of input (i.e., the structure of the language heard), the type of speech expected
by the environment, and perception of speech functions (i.e.,
whether parental speech is used to refer to persons or
objects).

McCabe (1989) proposes an interactional explanation for
the presence of individual differences in language
acquisition. She looks to the nonlinguistic context and the
linguistic correlates for the source of the interaction.
According to this model, the linguistic environment is
different for expressive and referential children; the source
of the variation in the linguistic environment is a function
of the nonlinguistic variables associated with each style,
leading to different contexts in which the child will acquire
language. For example, the presence of siblings results in a
different language learning environment, the less mature
speech of the sibling to the child and the more advanced
speech of the mother to the older sibling than that directed
to the younger child. As noted above, the referential style
is found most commonly among firstborns, higher socioeconomic
status children, and females; the expressive style is found
more often with laterborns, lower socioeconomic status
children, males, and children with poorer articulation and a
slower rate of vocabulary acquisition.
The Relationship between Motor Activity and Different Language-Learning Contexts

The present study examines an aspect of the different context that arises in relation to the different rate, and consequently, the different age of acquisition. Nelson (1973) found that expressive and referential children acquired a vocabulary of 10 words at roughly the same age (15 months) but that by age 2, there were significant differences in the number of words in their lexicon. Referential children, on average, had a vocabulary of 215 words; expressive children had a vocabulary of 144 words. The pattern of acquisition after the initial 10 words was different for the two groups. Referential children experienced a rapid acquisition of words shortly before reaching a vocabulary of 50 words. Expressive children appeared to have a slower, steadier pace of acquisition, without the burst of word learning around the 50-word mark.

While a child may acquire language at a slower rate, his/her motor development is not necessarily slower as well. This is likely to result in a different language learning environment for the expressive and referential child. For example, an older child is generally better able to manipulate objects and is more advanced in gross-motor skills. This ability to manipulate objects would lead the child to examine details of objects while a less motorically advanced child would not. At the same time, the child would no longer be as
interested in labels of whole objects and parents would also
focus on the child's manipulation, rather than the object.
More advanced gross-motor skills also allow a child to
negotiate his/her surroundings more quickly and confidently,
(e.g., running, climbing, leaving the mother's presence). The
parent is then more likely to use such expressions as "Don't
touch that", "Get down off of there", and "Where are you
going?" (McCabe, 1989) in order to maintain more control.
Interestingly, a higher number of directives and deictic
pronouns were found to be a characteristic of mother's speech
to expressive children (Nelson, 1973). As well, more mobile
children are less likely to spend time in quiet activities,
such as looking at books which results in much object naming.

Why would parents of both referential and expressive
children not concentrate on actions instead of objects, thus
providing similar language learning environments? One cannot
assume that the expressive child is any more advanced
motorically than a referential child of the same age.
Therefore, one must look again at the pattern of acquisition
that children using both styles experience. Referential
children appear to experience a "burst" of vocabulary
acquisition very close to the 50-word level of vocabulary.
They seem to experience an "every object has a name" concept
and this leads to a tendency to go "label-crazy". This would
be a very salient aspect of their behavior. Expressive
children do not experience this burst of labelling and
continue to pick up labels, as well as other words, at a slower rate. Parents of referential children, seeing their child’s interest in labelling objects, will usually oblige by labelling objects. Parents of expressive children may not see a similar interest, and thus not increase the frequency of their object-labelling. However, because any child’s motor development is quite salient at this age, for both child and parent, the parent would no doubt speak about what the child is doing motorically. This would lead to a different language learning environment for the expressive and referential child. A further comment must be made here. Parents of referential children would also comment on motor activity, but would be more likely to label the object with which the child is interacting.

Interestingly, this explanation proposes, not that a particular language learning environment leads to a certain style, but that style and environment are mutually interactive. Motor development may be a variable contributing to the maintenance of an expressive type of vocabulary.

**Is There a Link between Motor and Language Development?**

There is some support for the proposition that a parent responds to the child’s motor activity. Retherford, Schwartz & Chapman (1981) suggest that mothers are more likely to be attuned to the child’s activity than to what the child can actually comprehend of the verbal input. Goldfield (1987)
studied the relationship between object-related play and expressive and referential styles of speech in children. She found that the greatest number of object words was found in the vocabularies of those children who used toys to get their mothers' attention and whose mothers talked about the toys to the children. The greatest number of social-centred words were found in the vocabularies of those children who did not use toys to get their mothers' attention and whose mothers did not talk about the toys with them. Different interpretations of this can be given. First, mothers talked about things in which the child is interested, that is, toys or not. Secondly, the children who did not use toys as means to get attention were using other techniques. Perhaps they were such things as self-help behaviours or other non-object-related motor acts, such as running or jumping. Unfortunately, the study did not address this question.

While there is a dearth of studies on the direct link between motor development and speech or vocabulary, the literature does show a link between overall levels of motor and language development. Most studies of infants and preschoolers include testing of verbal and motor development (Bachara & Phelan, 1980, Hughes & diBrezzo, 1987, Kaplan & Dove, 1982, Laveck et al., 1983, McLoughlin & Gallo, 1982, Poresky & Henderson, 1982, Siegel, 1979, Siegel, Saigal, Rosenbaum, Morton, Young, Berenbaum & Stoskopf, 1982, Smith & von Tetzchner, 1986). Most report a present relationship
between the two (i.e., low motor skills are associated with low verbal scores) and often motor development scores will predict later language development. For example, Siegel (1979) tested infants at ages four, eight, twelve, eighteen, thirty, and thirty-six months and found that motor scores on the Psychomotor Development Index of the Bayley Infant Scales of Development (BSID) at four and eight months were good predictors of later language abilities, as measured by the Reynell Developmental Language Scale; as well, low motor abilities could predict developmental delay in language. Interestingly, parents providing appropriate play materials was the best predictor of language development at thirty and thirty-six months (Siegel, 1979). McLoughlin and Gallo (1982) found that when administering the McCarthy Scales of Children's abilities to three- and four-year olds, the motor scales, among others, were significantly related to verbal performance at age four, but not at age three. They explain this by suggesting that different skills contribute to verbal behavior at different ages in the preschool years. Poresky and Henderson (1982) also found a correlation between mental (which includes verbal) and motor development as measured by the BSID in a study of the relation between home environment, maternal attitudes, marital adjustment, and socioeconomic status and mental and motor development. Furthermore, they also found that girls' motor development was more affected by socioeconomic status than was boys and that it was more
advanced as the amount of father care increased. One may suspect that both higher socioeconomic status and greater father involvement provide more opportunities for girls to engage in motor activity; boys may have opportunities for motor activity regardless of these variables. This may act to support a relationship between mental and motor development at higher socioeconomic levels.

It has been observed in many studies that a delay or deficit in language development is often associated with a motor delay or deficit. Kaplan and Dove (1987) administered the Denver Developmental Screening Test to children in a study on the Ache tribe in Eastern Paraguay, and found quite a delay in gross and fine-motor development as compared to American children. The Ache spend much time foraging in the forest and thus adopt, of necessity, a very restrictive child-rearing pattern; the children are not allowed to explore and are kept close to their mothers. The delay in motor development is attributed to this; however, researchers also found language delays in the children (Kaplan & Dove, 1987). Silva, Justin, McGhee and Williams (1984) studied a sample of British children and found that children at age seven who were delayed in speech and had a low IQ were delayed in motor skills, whereas those who had a speech delay but a normal IQ did not have an accompanying motor skill deficit. They examine this relationship no further, however. In another article on the same sample of children, Silva, McGhee and Williams (1982)
report that low IQ’s and/or reading difficulties at age seven as measured by the Burt Re-arrange Word Reading Test could be predicted by previous delays in developmental milestones; slow walking or slow walking and talking, but not slow talking alone were good predictors of later problems. Hughes and diBrezzo (1987) found that children who had been physically and emotionally abused and/or neglected experienced a combination of language deficits and deficits in motor coordination. Smith and von Tetzchner (1986) studied the communicative, sensorimotor, and language skills of young children with Down Syndrome and found that fine-motor, gross-motor and language skills at age two as measured by the Gesell scales predicted these children’s language skills as measured by the Reynell Developmental Language Scales at age three. However, they chose to emphasize these children’s language deficits instead of the link between motor and language development. LaVeck, Hammond, Telzrow, and LaVeck (1983) assessed behavior, intelligence, expressive language (using the Fluharty Speech and Language Screening Test), and motor development (using the Motor Scales of the McCarthy Scales of Children’s Abilities) in a group of four-year old children who had minor congenital anomalies that had been identified during infancy. Examples of anomalies are fingers curved unusually, gaps between toes, toes not the usual length, and anomalies in palate shape. There was a positive correlation between having a minor abnormality and a deficit in language and motor
skills, particularly gross-motor skills only in children of a lower socioeconomic level. The authors suggest that having anomalies is associated with a more cautious style in the child. To compound this effect, parents in the lower socioeconomic group do not and/or cannot provide as many opportunities to learn new skills, leading to a deficit. Thus, they propose that what the children are doing nonlinguistically affects their language skills.

Autistic children are often characterized by a very slow rate of development in vocalization and body movement as compared to normal children (Wenar et al., 1986). Ornitz, Guthrie, and Farley (1977) found that motor delay in autistic children was reported as early as, or earlier than, the reported language delay and that these delays were highly correlated. When comparing non-speaking and speaking autistic children at age 7 on measures taken at age 4 1/2 years, scores on the intellectual, self-care, various speech production features, and motor ability at age 4 1/2 were the most distinct indices to differentiate the two groups (Nishimura et al., 1987). Motor ability scores were the lowest significant predictor, however, and the authors did not address its presence as a predictor.

Intervention programs with young children often suggest work on skills leading to motor development. Wooden, Lisowski, and Early (1976) found that by school age, many children have learning disabilities, often characterized by
language disabilities. They hypothesized that if intervention were to take place in preschool years, deficits in children’s IQ scores could be avoided. Volunteers were asked to work with children aged three to five years in Head Start preschool programs for disadvantaged children. After a period of months, the children’s IQ scores had increased. Interestingly, gross-motor and tactile skills were included among the areas worked on. Mori and Olive (1978) suggest that work on reflexes, and gross-motor and fine-motor skills should be included in an intervention program with blind infants. They also suggest that parents be warned that motor development will probably be delayed and thus that language development will be delayed because mobility skills usually precede the development of language.

A few studies have examined a direct link between language acquisition and motor development. Bonvillian, Orlansky, and Novack (1983) state that language and motor milestones occur in a roughly synchronous fashion in normal populations, suggesting a maturational component. However, in children of deaf parents who used sign language with their infants, the infants acquired their first signs at a much earlier age than the norm as well as the development of a fifty-word vocabulary and the combining of two words in sign language. Motor language was acquired and developed much faster. Also, with many signs, it was difficult to determine whether the sign referred to an object or the action
accompanying it, for example, the sign for airplane could have meant airplane or flying. Gallivan (1987) found that the order of motion verbs (e.g., kick, walk, run, jump) could be predicted by the order of acquisition of these motions instead of being predicted by the words' semantic complexity.

However, some studies find that motor development is not predictive of language development. Crowe, Deitz and Bennett (1987) studied high-risk children, some of whom had received therapy. They measured the infants' mental and motor development using the Bayley Scales of Infant Development (BSID) at ages 4 months, 1 year and 2 years. At age 4 1/2, they administered the Peabody Developmental Gross Motor Scale (PDGMS) and the Wechsler Preschool and Primary Scale of Intelligence (WPPSI). At 4 months, neither scale of the BSID correlated significantly with the PDGMS or the WPPSI. At 12 months, the mental scale correlated with both the PDGMS and the WPPSI, but the motor scale only correlated with the PDGMS. As well, the correlations were low; these relationships only accounted for 11% to 21% of the variance of the scores at 4 1/2 years. Bachara and Phelan (1980) report that deaf children show poor language development in the form of delayed communication skills (ML Sign as measured in Bloom and Layley's Test of Language Development) as well as delays in fine motor development. However, they suggest that the relation between the two is not strong. In a group of five- and eight-year olds, there was a significant relation between
measures of fine motor and language development but some children showed a high level of fine motor development and scored poorly on language or vice versa. They feel further research is needed on these areas. Silva and Bradshaw (1980) looked at variables that could be correlated with children’s IQ at age 5 and included both verbal measures (i.e., when the child first talked in sentences, and verbal comprehension and expression at age 3) and motor measures (e.g., when the child first walked and his/her score at age 3 on the Bayley Motor Scale). They found that language development was the best predictor of IQ. Motor scores significantly predicted IQ at age 5, but the correlation was low and these scores did not add much predictive power to the language scores. Finally, in a study done with preterm and full-term infants (Siegel et al., 1982), preterm infants were lower than full-term infants on cognitive, language (as measured by the Reynell Developmental Language Scales) and motor development (as measured by the Bayley Motor Scale) but when scores were corrected for prematurity, only the motor developmental scores were lower than for the full-term group, that is, the infants were still delayed in motor development even when compared to younger age norms. This implies a lack of a maturational link between motor and language development or that adverse reproductive and perinatal factors producing central nervous system damage may be more specific to motor functions than to language and cognitive processes. Finally, Nelson (1973)
measured motor development using the Motor Scale of the BSID and found that children's scores on motor development did not correlate significantly with any of her language measures. She therefore dropped this variable from all other analyses.

It is difficult to make sense of this conflicting evidence. One reason is that when there is a correlation between motor and language development, either at the same time, or in a predictive relationship, this link is rarely explored by the researchers. This is perhaps because they assume that both are a result of maturational processes and that is why language and motor skills develop in synchrony. The most contradictory finding for the purpose of this paper is the lack of a correlation in Nelson's study. However, Nelson used the Bayley Scales of Infant Development which are performance tests, not necessarily an examination of what the child is typically doing every day. As well, there is an emphasis on gross-motor development in this scale, and she did not compare both fine and gross-motor skills to language development. There does appear to be a recurring pattern in the previous studies in that the opportunity to explore the environment appears to be associated with language development, and the lack of opportunity to explore the environment is accompanied by deficits in language development. As well, Nelson (1973) at one point states that one of her expressive children, due to his highly motoric approach to the world (he was quite active) chose to describe
actions and events rather than objects or social situations. Thus his motor activity level appeared to affect his language development.

As previously mentioned, there appears to be a dearth of studies on the direct link between motor development and speech. Some researchers recognize this. Melby, Pease and Kleckner (1987), who developed the Iowa Pegboard Task that measures fine-motor skills, decry the lack of study on motor development and performance in relation to other areas, particularly in the preschool years when so many changes in motor development take place. Hughes and diBrezzo (1987) also suggest that study of the psychomotor domain is especially important because rates of growth and maturity influence other domains. What may be important in the area of language acquisition is the opportunity to explore; unfortunately, the type of exploration, that is, gross and fine-motor manipulation, and its effect on language acquisition has not yet been the topic of any study.

The Present Study

McCabe's model makes certain predictions with regard to motor development and language acquisition. Specifically, it predicts that children whose speech shows more expressive characteristics will be more advanced in gross- and fine-motor skills than children whose speech shows referential characteristics at similar language levels. This is due to
certain characteristics of speech associated with more advanced activities. Speech to children with more advanced gross-motor skills would be expected to include directives intending to maintain physical proximity. Parents’ speech to children advanced in fine-motor skills would be expected to include many deictic pronouns; these express relationships between objects and the action more so than representing the objects themselves. As well, parents’ speech would be expected to contain more comments on the child’s actions than on the objects upon which the child is acting. With regard to the interactional aspect of the model, children with more advanced fine-motor skills would also be expected to respond more often, either verbally or nonverbally, to parental comments about these actions than about the objects.

The purpose of this study was to test these and related predictions concerning motor skills and language acquisition. The experimental part of the study created different contexts of motor activity. The first context was that of gross-motor activity, specifically, play with whole objects. The second context was that of fine-motor activity, specifically, manipulating small parts. Dealing with whole objects was expected to elicit speech associated with referential communication. Manipulating small parts was expected to elicit speech associated with expressive interchange. The correlational part of the study tested the model’s prediction that for children at similar language levels, the more
motorically advanced child will tend to adopt an expressive style of speech.

This study provided children with both fine-motor and gross-motor tasks in order to see if different language was produced by both parent and child in accompaniment. The following hypotheses were tested:

1) Different language will be produced by parents during different motor activities, in particular,
   a) fine-motor activity will be associated with more pronouns, deictic pronouns, and directives, and less object labelling;
   b) gross-motor activity will be associated with more object labelling by parents.

2) Different language will be produced by the child while engaging in these activities, in particular,
   a) fine-motor acts will be associated with more pronouns, and deictic pronouns, and less object labelling;
   b) gross-motor activities will be associated with more labelling by the child.

3) The child will respond differently to the language directed toward him or her;
   a) during the fine-motor tasks, the child will respond more to comments on actions and less to object labelling;
   b) during the gross-motor tasks, the reverse is
expected.

As well, a measure of present motor development was taken to see if advanced motor skill was related to the style of speech used, leading to the final hypothesis:

4) The child who is advanced motorically, as determined by a parental report measure of motor development, in comparison to language development, as measured by MLU, will have an expressive style of speech. Conversely, the child who is not advanced motorically, but is linguistically advanced, will be expected to have a referential style of speech.
CHAPTER II

METHOD

Subjects

Sixteen subjects, eight males and eight females, ranging in age from 18 to 30 months with an accompanying range of MLU between 1.09 and 3.53 ($M = 1.97$) and their mothers took part in the study. These subjects were solicited through contacts with local daycare centres and personal communication (see Appendix A for sample parent letter) and represented a predominantly middle class socio-economic background. Mothers were told that the experimenter was conducting a study on language and motor development in young children.

Instruments

The Motor Skills Domain of the Vineland Adaptive Behavior Scales, Expanded Form (VABS) (Sparrow, Balla & Cicchetti, 1985) was used to assess the child’s present motor functioning. The VABS, a revision of Edgar Doll’s 1935 Vineland Social Maturity Scale, measures adaptive behavior through administration of the scales in an interview with a parent, caregiver, or teacher who is very familiar with the child on a daily basis. Adaptive behavior domains include Communication, Daily Living Skills, Socialization, and Motor
Skills. An Adaptive Behavior Composite can be derived from these domain scores; there is also a Maladaptive Behavior domain. The Survey Form and Expanded Form of the VABS have been standardized on samples of handicapped (N=2850) and nonhandicapped (N=3000) individuals from across the United States, thus providing adaptive levels and age equivalents for each domain and subdomain.

Split-half reliability coefficients for the Motor Skills domain (N=1200) for the Expanded Form range from 0.97 (age 0-11 months) to 0.83 (age 5 years to 5 years, 11 months). Test-retest reliability coefficients for the Survey Form (a shorter version) for the Motor Skills domain (N=40) range from 0.78 to 0.82. The interrater reliability coefficient for the Survey Form for the Motor Skills domain (N=77) is 0.78. The Survey Form coefficients are considered to be the lower bound estimates for the Expanded Form; because the Expanded Form is longer, reliability coefficients would be expected to increase.

Construct, content, and criterion-related validity data have been collected on the VABS. The following concerns the entire scale, not just the Motor Skills domain. The fact that scores do, in fact, increase with age is evidence that the VABS measures age-related adaptive behavior. In support of this, the Maladaptive Behavior domain, which would be expected not to experience a similar developmental progression, exhibits only a slight or no relationship with age. Factor
analysis showed that the subdomains (e.g., fine and gross motor) did, in fact, belong in their particular domain. Interestingly, between the ages of 2-0-0 to 3-11-30, Motor Skills and Daily Living Skills subdomains formed one factor. In correlating the VABS with other scales, it was found that the VABS correlated more highly with other adaptive behavior scales than with intelligence. However, the correlations were not so high as to make the VABS redundant.

The VABS items were culled from careful review of other adaptive behavior scales and child development literature which yielded an original pool of about 3000 items. The number was reduced and much field testing, item tryout, and standardization satisfied the researchers’ concerns that content validity was obtained. The VABS had been compared to its predecessor, the Social Maturity Scale, and other adaptive behavior scales. Correlations between the VABS and its predecessor are positive and range between 0.55 and 0.88.

As well, Goldstein (1985) compared parental report of motor development using the Motor Scale Survey Form of the VABS with obtained scores on the Bayley Scales of Infant Development, an objective measure of infants’ motor ability (N=77). The age equivalents on both measures were not significantly different and the correlation between the scores on the measures was 0.86, indicating that the parents of 1-year olds were able to give accurate accounts of the age at which their infants reached motor development milestones.
Linguistic Measures

1. Child's Mean Length of Utterance (MLU): This measure was calculated from each transcript in accordance with the guidelines established by Brown (1973) and modified by Nelson (1973). This measure was used for hypothesis 4.

2. Noun use ratio, during each motor activity: Determined by

\[
\frac{\text{Nouns}}{\text{Nominals}} \quad \text{and} \quad \frac{\text{Nouns}}{\text{Nominals}}
\]

Note: Nominals = nouns + pronouns (Nelson, 1973).

This was used for hypotheses 1 and 2.

3. Child noun use ratio for the whole session: Determined by

\[
\frac{\text{Nouns}}{\text{Nominals}} + \frac{\text{Nouns}}{\text{Nominals}}
\]

This was used to determine what linguistic style the child preferred. A child with a 55% or greater noun use ratio was considered to prefer a referential style; a child with a 45% or less noun use ratio was considered to prefer an expressive style of speech.

4. The child's Noun Type/Token Ratio (NTTR): This is a measure of lexical variability. It is the ratio of the total number of orthographically different nouns to the total number of nouns (Hummel, 1982). This was used as a supplementary
measure to the MLU of language development and was used to test hypothesis 4.

5. Deictic Pronouns: These are pronouns used to indicate place and that serve a pointing function (e.g., here, there, this, that, these, those). This was used to test hypotheses 1 and 2.

6. Directive Statements: There were two types used in this study; imperatives and indirect directives. Imperatives are explicit requests for an action or an object, for which the subject usually has been deleted (e.g., "Come back here.", "Put the round one in.") (Hummel, 1982). Indirect directives are utterances that serve as a request for action on the basis of the context in which they were produced, but that have the surface form of an information-seeking or yes-no question (e.g., "Can you show Mama?", "Why don’t you move the blocks?", "Kiss the clown?") (Hummel, 1982). This was used to test hypothesis 1.

7. Object Labelling: These were statements which simply named the object or requested the child to point to an object or part of the object (e.g., "It’s a firehouse.", "Where’s his nose?"). Only labels of objects with which the people were playing were included; thus names of pretend objects were not included. This measure was used in testing hypotheses 1, 2, and 3.

8. Opportunities for Response to Object Labelling: Often a mother’s object labelling was a direct imitation of the
child's object labelling, or a confirmation of the child's provision of an object label, as in the following exchange:

Mother: "What's this?"
Child: "Firetruck."
Mother: "Firetruck. Right"

These incidences were left out of analysis for the third hypothesis and the remainder of mothers' object labelling were considered opportunities for response to object labelling.

9. Comments on Action: These were statements by the parent concerning the child's actions as opposed to the object with which he/she was playing. They were confined to actions concerning the toy the child was currently playing with. They included imperatives, indirect directives, and other statements that commented on the child's current action (e.g., "Can you catch it?", "I think you should put it there.", "You're throwing it."). Often a parent had many statements within the same turn intended to get the same result. The last such statement within a turn was counted as one comment on action. For example, only one comment on action was counted for the following: "Can you catch it? Catch! Try and catch it!". This was used in testing hypothesis 3.

9. Child's response to object labelling: Four types of response were recorded; no response, nonverbal response, verbal + nonverbal response, and verbal response. This was used to test hypothesis 3.
10. Child's response to comments on action: Four types of response were recorded; no response, nonverbal response, verbal + nonverbal response, and verbal response. This was used to test hypothesis 3.

Procedure

After initially contacting the parent, the experimenter visited the home at a time convenient for the parent. The Motor Skills domain of the Vineland Adaptive Behavior Scales, Expanded Form was administered first in order to allow the parent and child to become comfortable with the experimenter. After completion, the experimenter asked the mother and child to play with some toys provided by the experimenter. The toys were designed to elicit fine-motor activity and gross-motor activity involving objects. Fine-motor toys were provided as a group to be played with for fifteen minutes and then gross-motor toys were provided as a group to be played with for fifteen minutes. The order was reversed for half the subjects to control for order effects. Fine-motor tasks included buttoning, zipping, placing shapes in appropriate holes, doing a puzzle with smaller pieces, playing with a doll, and manipulating objects with intricate parts (Fisher-Price Main Street). Gross-motor tasks included playing with foam megablocks, playing with a football, playing a ball toss game, playing hockey, playing with a large clown doll with no
moveable parts, and hammering. The child played with any of the provided toys he/she wished for any length of time desired. The interaction was videotaped. A back-up audiotape recorder was also used to record the interaction in case of equipment failure.

The videotapes were then transcribed and coded for language variables, as well as for the contextual factors of gross and fine motor activity.

**Interrater Reliability**

Interrater reliabilities were obtained for transcribing and coding of linguistic measures on twenty percent of the transcripts. The formula used was the number of words/codings agreed between experimenter and second rater, divided by the experimenter’s words/codes. Comparisons were made for the entire session, disregarding gross and fine motor context. Reliabilities for coding were obtained from the experimenter’s transcripts so as to separate the issue of transcribing and coding of linguistic category. Reliabilities for transcribing ranged from 0.75 to 0.91. The second rater provided total counts for the linguistic measures of nouns, pronouns, deictic pronouns, and noun types. For the linguistic measures of directive statements, object labels, opportunities for response, comments on action, and response to object labelling, the second rater indicated each code on the transcript so that each code could be compared for agreement
or disagreement. Reliabilities for the comments on action measure averaged 0.33. Because the reliability was unacceptably low for this variable, this category and necessarily the child's response to comments on action were dropped from analysis. Reliabilities for the other categories ranged from 0.78 for directive statements and responses to object labelling to 0.99 for number of nouns in the mothers' speech (See Appendix C for reliabilities for each category).
CHAPTER III

RESULTS

Hypothesis 1 -- Mother Speech

Hypothesis 1 predicted that during play with the fine-motor toys, in contrast with the gross-motor toys, mothers would produce more pronouns, more deictic pronouns, more directive statements and less object labelling, and that gross-motor activity would be associated with more object labelling. To examine this hypothesis, 2 (Gender) x 2 (Motor Activity) Repeated Measures Analyses of Variance (ANOVA's) were conducted. As seen in Table 1, a significant difference in general pronoun use between fine and gross motor activity for mothers was not found, but there was a significant difference in the use of deictic pronouns in the intended direction, F (1,14) = 25.81, p < .001. There was also a significant effect for object labelling, although in the direction opposite that expected; mothers labelled objects more during the fine-motor play than during gross-motor play, F (1,14) = 12.48, p < .01.

Table 2 indicates a significant difference in the use of directive statements; again this effect was opposite to that expected. Mothers produced more directive statements during gross-motor play than fine-motor play, F (1,14) = 13.33, p <
Table 1
Means of Mothers' Speech during Gross and Fine Motor Play

<table>
<thead>
<tr>
<th></th>
<th>Gross</th>
<th>Fine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nouns/Nominals</td>
<td>52.71 %</td>
<td>31.41 %</td>
</tr>
<tr>
<td>Deictic pronouns</td>
<td>43.68</td>
<td>65.93 ***</td>
</tr>
<tr>
<td>Object labelling</td>
<td>17.06</td>
<td>25.87 **</td>
</tr>
</tbody>
</table>

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

Table 2
Means of Mothers' Use of Directive Statements

<table>
<thead>
<tr>
<th></th>
<th>Gross</th>
<th>Fine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Directive statements</td>
<td>56.50</td>
<td>38.31 **</td>
</tr>
<tr>
<td>Indirect directives</td>
<td>8.69</td>
<td>5.25 *</td>
</tr>
<tr>
<td>Imperatives</td>
<td>47.81</td>
<td>33.06 **</td>
</tr>
</tbody>
</table>

** p < .01
* p < .05
.01. Analysis of both types of directive statements indicates that there were significant differences in the same direction in the use of both indirect directives, $F (1,14) = 4.58, p < .05$, and imperatives, $F (1,14) = 9.82, p < .01$ (See Table 2). The latter must be interpreted in light of a significant gender by motor activity interaction in mothers’ use of imperatives, $F (1,14) = 5.34, p < .05$. Simple Effects post-hoc testing indicates that mothers of males produced significantly more imperatives during gross-motor play than during fine-motor play, $F (1,7) = 11.03, p < .05$, but mothers of girls did not (See Table 3). No other Simple Effects tests were significant.

**Hypothesis 2 -- Child Speech**

The second hypothesis predicted that the child would produce more pronouns, more deictic pronouns and less object labelling during fine-motor play, and that gross-motor activity would be associated with more object labelling. No differences in overall pronoun use were found, but a significant difference in the expected direction was found for deictic pronouns, $F (1,14) = 4.99, p < .05$ (See Table 4). There were no other significant differences found in the children’s speech during fine and gross-motor activity. Of interest is the finding that children did not use significantly more object labelling during fine-motor play,
Table 3

Gender X Activity and Mothers' Use of Imperatives (Means)

<table>
<thead>
<tr>
<th></th>
<th>Gross</th>
<th>Fine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mothers of males</td>
<td>58.25</td>
<td>32.63*</td>
</tr>
<tr>
<td>Mothers of females</td>
<td>37.38</td>
<td>33.50</td>
</tr>
</tbody>
</table>

* p < .05

Table 4

Means for Children's Speech during Gross and Fine Motor Play

<table>
<thead>
<tr>
<th></th>
<th>Gross</th>
<th>Fine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nouns/Nominals</td>
<td>51.63</td>
<td>42.78</td>
</tr>
<tr>
<td>Deictic pronouns</td>
<td>20.00</td>
<td>28.00*</td>
</tr>
<tr>
<td>Object labelling</td>
<td>20.56</td>
<td>22.93</td>
</tr>
</tbody>
</table>

* p < .05
although mothers did. For interest, means comparing mothers’ and children’s use of object labelling are shown in Table 5. Children used more object labelling during gross-motor activity than did the mothers, and mothers used more object labelling during fine-motor play than did the children.

Hypothesis 3 -- Response of Child to Mother Speech

The third hypothesis dealt with the linguistic interaction between mother and child during different motor activities. Specifically, it was predicted that the child would respond differently to the language directed toward him or her; during fine-motor tasks, the child would respond more to comments on actions and less to object labelling, but during gross-motor activity the reverse was expected. As previously mentioned, the comments on action measure was too unreliable to warrant further discussion.

It must first be noted that there was a significant difference in mothers’ opportunities for responding to object labelling. Mothers provided more opportunities for response to object labelling during fine-motor play (M = 22.50) than during gross-motor play (M = 14.31), F(1,14) = 9.28, p < .01. This result is not surprising, as opportunities for response are a function of the mothers’ object labelling which had a similar difference to that found here.

Interestingly, in spite of the mothers providing more opportunities for response during fine-motor play, children
Table 5
Comparison of Means for Object Labelling between Mothers and Children

<table>
<thead>
<tr>
<th></th>
<th>Gross</th>
<th>Fine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mothers</td>
<td>17.06</td>
<td>25.87</td>
</tr>
<tr>
<td>Children</td>
<td>20.56</td>
<td>22.93</td>
</tr>
</tbody>
</table>
responded significantly more to opportunities provided during gross-motor play ($M = 63.29$) as compared to fine-motor play ($M = 51.25$), supporting the hypothesis, $F(1,14) = 6.93, p < .05$.

Hypothesis 4 -- Motor Development and Language Acquisition Style

The Motor Scale of the Vineland Adaptive Behavior Scales was used to measure the typical functioning of the child's present motor development. Raw scores, rather than scores adjusted for age, were used to divide children into two groups. This is because it was expected that parents respond to the absolute level of motor functioning rather than to the child's level relative to others. The scores ranged from 71 to 103 and there appeared to be no difference between the males and females in motor ability (girls' mean raw score = 87.3 and boys' mean raw score = 85.0). Children were divided into Lo-Motor and Hi-Motor groups by a semi-median split. The reason for this semi-median split was that at the median three children had a raw score of 88 and the next lowest score was 85, thus all those children obtaining 88 were placed in the Hi-Motor group, resulting in 7 in the Lo-Motor and 9 in the Hi-Motor group.

A median split was also performed according to the child's MLU and children were placed in either a Hi-MLU or Lo-MLU group. Children with an MLU of 1.75 and lower were placed in the Lo-MLU group; children with an MLU of 1.79 and higher
were placed in the Hi-MLU group. The children with an MLU of 2.5 or more were then left out of further analyses as it has been found that pronoun use becomes quite similar in expressive and referential children at MLU's of this level. Thus, three children were left out of the final analysis. Children were classified expressive or referential according to their noun use ratio.

According to Hypothesis 4, those in the Lo-MLU and Hi-Motor group would be expected to display an expressive style of speech. Those in the Hi-MLU and Lo-Motor group were expected to adopt a referential style of speech. There were no specific hypotheses as to what style the other groups would show.

This hypothesis was not supported. Instead, as seen in Table 6, all of those in the Hi-Motor, Lo-MLU group showed a referential style of speech and there was a mix of styles in the Lo-Motor, Hi-MLU group. As well, all those in the Hi-Motor, Hi-MLU group adopted an expressive style of speech.

Part of the reason for the differing rate of language development in the expressive and referential child's speech is tied to the "word burst" that the typical referential child experiences and the typical expressive child does not. As well, MLU for an expressive child is sometimes inflated due to their early preference for formulaic and unanalyzed expressions. Thus it was decided to use a measure of language development which is more tied to vocabulary than is MLU, that
of noun-type token ratio (NTTR). Children were ranked in terms of their NTTR and then a median split was performed into a Lo- and Hi-NTTR group. Children with a NTTR of 33.50% and lower were placed in the Lo-NTTR group; children with a NTTR of 35.00% and higher were placed in the Hi-NTTR group. Six children had similar low and high group classifications as that using MLU, thus 10 fell into a different group.

Most of the children fell into the two groups for which no hypotheses were made and these groups were quite mixed in terms of language style used (See Table 7). Partial support was provided for the hypothesis that those with a low level of language development but a high motor development would adopt an expressive style of speech. The Hi-Motor, Lo-NTTR group contained one referential child and two expressive children; the Lo-Motor, Hi-NTTR group contained one referential child and one child with an unclassifiable style.
Table 6

**Linguistic Styles in Lo- and Hi- Motor and MLU Groups**

<table>
<thead>
<tr>
<th></th>
<th>Lo-Motor</th>
<th>Hi-Motor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lc-MLU</td>
<td>2 Referential</td>
<td>3 Referential</td>
</tr>
<tr>
<td></td>
<td>1 Expressive</td>
<td>1 51% *</td>
</tr>
<tr>
<td></td>
<td>1 51%</td>
<td></td>
</tr>
<tr>
<td>Hi-MLU</td>
<td>1 Referential</td>
<td>3 Expressive</td>
</tr>
<tr>
<td></td>
<td>1 Expressive</td>
<td></td>
</tr>
</tbody>
</table>

* percent nouns/nominals

Table 7

**Linguistic Styles in Lo- and Hi- Motor and NTTR Groups**

<table>
<thead>
<tr>
<th></th>
<th>Lo-Motor</th>
<th>Hi-Motor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lo-NTTR</td>
<td>3 Expressive</td>
<td>1 Referential</td>
</tr>
<tr>
<td></td>
<td>2 Referential</td>
<td>2 Expressive</td>
</tr>
<tr>
<td>Hi-NTTR</td>
<td>1 Referential</td>
<td>2 Referential</td>
</tr>
<tr>
<td></td>
<td>1 51% *</td>
<td>1 51%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 Expressive</td>
</tr>
</tbody>
</table>

* percent nouns/nominals
CHAPTER IV

DISCUSSION

The suggestion within McCabe's model that the development of an expressive or referential style of speech is partially influenced by the level of motor ability of the child hinges on the contention that different motor contexts result in different speech by parent and child, as well as more interest by the child in certain linguistic forms during one type of motor activity over another. However, no study, to the author's knowledge, has yet been conducted to examine whether, in fact, different motor contexts have this result. Thus the present study experimentally created two motor contexts, fine- and gross-motor play. In these contexts, interaction with the toys was expected logically to elicit either referential or expressive interchange. Accordingly, three specific hypotheses were made as to the type of speech and the type of interaction expected during gross- and fine-motor play.

Parent Speech

The first hypothesis was concerned with parental speech directed to the child during the interaction with the toys. It was expected that parents would use more pronouns, more deictic pronouns, and more directives during fine-motor play and more object labelling during gross-motor play.
As expected, mothers directed significantly more deictic pronouns to the child during fine-motor play than during gross-motor play. There was much interaction in which the mother and child discussed where to place an object or clarified which object was to be put in a certain place. Thus statements such as "Put it here." and "This?" were common during play with the fine-motor toys. This was in keeping with the contention that deictic pronouns would be more common when the focus was on the action with the objects than on the objects themselves.

Further support for the hypothesis that different motor context produces different parental speech was provided, although not in the expected direction. It was predicted that fine-motor play would produce more directive statements by the mothers than would the gross-motor context. However, the opposite was found; mothers produced more directives during gross-motor play than during fine-motor play. In particular, mothers of boys used more imperatives during gross-motor play than during fine-motor play, but this difference was not evident in speech of mothers to the girls. These appeared to be of two general types; imperatives that instructed the child how to use the toys and attempts to get the child to stay in the room. The latter were the type of statements McCabe (1989) suggests are typical of speech directed to more motorically advanced children, such as "Come back here!" There is a strong possibility that the gross-motor context was
more challenging than expected. For example, the hockey stick and ball were quite popular gross-motor toys, especially with the boys, but much instruction as to how to use them and what not to do with them was part of the interaction with the toys. As well, it often resulted in the ball leaving the play area and the child searching for it. This resulted in many attempts by the mother to maintain physical proximity by directing the child to come back into the room. Fine-motor play for both boys and girls tended to be somewhat more sedate and took place in one spot. As well, the interaction with the girls during gross-motor play tended to be somewhat calmer than for boys, although not sufficiently so to elicit a difference in imperative use between mothers of girls and boys during gross-motor play.

Gross-motor play elevated the use of imperatives for mothers of boys, but not for girls. For girls, interaction with the toys was similar during both fine and gross-motor play; however, boys showed a marked difference in activity level for the two contexts. The gross-motor toys seemed to appeal to the interaction between mother and son rather than mother and daughter. The preferred gross-motor toys for the boys were things like a hockey stick and a football, and many mothers of boys seemed more comfortable with this type of play than mothers of girls. As mentioned, this type of interaction naturally led to a need for more imperatives. Many of the mothers of girls also played with such toys, while others
tended to be at a loss with these toys and to prefer blocks, pointing out the parts of the tiger on the ball toss game, or joining pretend play by the child with the clown. These types of interaction were less active and also led to more discussion about the object itself rather than what should be done with it, contributing to a lack of difference in mothers' of girls use of imperatives between fine and gross-motor activity. It should be mentioned that it is also likely that mothers preferred certain activities due to their child's interests.

Other studies have found that an expressive style is found more commonly in males (Nelson, 1981) and is associated with a higher use of parental directives (Della Corte et al., 1983). It has also been found that parental speech to sons tends to contain more directives (Cherry & Lewis, 1978). Perhaps boys and their parents prefer gross-motor activity which, in this study at least, is associated with a greater use of directives. Thus motor activity may be influencing the type of linguistic interaction with boys which may in turn be influencing the linguistic style males are more likely to acquire.

Finally, contrary to expectation, there was significantly more object labelling during fine-motor play than gross-motor play with whole objects. This is in spite of a lack of difference in the use of nouns. Interestingly, more deictic pronouns were used by the mothers during fine-motor play which
indicates that there was a great interest in the action with the objects. However, there was also a great interest in labelling the objects. This was mainly due to the Fisher-Price Main Street toy which has many small manipulable parts, but which also has many interesting, slightly different, "labelable" parts, such as a firetruck, an ice cream shop, and a traffic light. This toy was a favourite with both the mothers and the children (some mothers were even more interested than the children!) and appeared to be somewhat new and exciting for both. Thus the mothers appeared to be discovering everything with the toy and labelling as they discovered each interesting new feature. Perhaps if a fine-motor toy that was more familiar to the child and mother had been used, this difference in object labelling would not have been present. It is difficult to say whether the other fine-motor toys elicited much object labelling, as so much time was spent with Main Street.

Child Speech

McCabe (1989) also predicts that different contexts arising from different levels of motor activity will result in different speech produced by the child. Accordingly, the present study examined the children's speech during fine-motor and gross-motor play to discover whether this occurs. Children's directive statements were not examined. As
expected, children, along with their mothers, produced more deictic pronouns during fine-motor activity than during gross-motor. However, unlike the mothers, there was no difference in object labelling between the two motor contexts, thus the children were not following their mothers' lead in providing labels for the objects. In fact, when comparing the means for labelling by mothers and children during the two types of play, children used more object labelling than mothers during gross-motor and less than mothers during fine-motor activity. While this comparison was not tested statistically, it indicates that children's speech was not being directly influenced by what the mother was saying, at least not for object labelling. This is somewhat counter to McCabe's model, which states that different speech will be produced in accompaniment. However, an immediate, direct effect is not necessary for object labelling in mothers' speech to affect the child's linguistic style. The possibility remains that the mother's interest in object labelling may lead to the child's understanding of language as that of a tool to describe the world and thus a tendency to label objects at a later time. Thus, while in this study the children did not respond to their mothers' object labelling with labels in their own speech, when faced with a new toy at a different time, they may label all the parts because that is what they learned from their mothers' previous example. The
interactional aspect of the linguistic context is examined in more detail in discussion of the next hypothesis.

**Response of Child to Mother Speech**

McCabe’s model partially rests on the assumption that mothers and children will be influenced in the same way by the context in which language is being acquired. It has already been seen that children do not always follow their mothers’ lead in producing the same type of speech during the same motor contexts, at least at that particular time. Stronger evidence for the independent contribution by the child to the speech interaction and possibly to language acquisition can be found when examining the children’s responses to their mothers’ opportunities for response. Children took advantage of opportunities for responding to object labelling significantly more often during gross-motor play than during fine, even though mothers provided significantly less opportunity to do so. This surprising finding provides support for the logical assumption that dealing with whole objects would result in the child’s greater interest in the label of the object. However, although children responded predominantly in verbal form, they did not necessarily provide object labels themselves. This finding also indicates that many of the object labels during fine-motor play that could have been responded to were simply ignored by the children.
A clue to this interesting finding can be found in examination of the quality of the interaction during the two different types of play. As mentioned previously, mothers were often more fascinated by the fine-motor toys, particularly Main Street, and played a bit with them on their own while the child was busy with another part of the toy. Thus, some of the object labels may have been ignored because the child was more interested in another part of the toy. Conversely, the object labels during gross-motor play were usually provided while the child was actually playing with the toy. Nelson (1973) found that many of the children's first words included labels of objects upon which they had acted, rather than simply those with which they were most familiar. This appears to be true in the present study; it is the child's interest in the object, not merely the mother providing its label, which may lead to that label appearing in his or her vocabulary. Thus, the contention that the child contributes independently to the linguistic interaction and ultimately to language acquisition is supported.

It is also likely that the child contributes to the development of a particular style through the interaction of motor activity and the child's notion of the purpose of language. If the child has an understanding of language as a tool to describe his or her world, then the greater interest in object labels while acting upon the objects is more likely to lead to an increase in object labels in his or her
vocabulary. There is no reason to believe that a child who views language as a tool to maintain personal interaction is any less likely to play with and be interested in objects; however, the object labels provided may not be of as much interest and therefore acting upon toys whose labels are given may not necessarily lead to a drastic increase in object labels in this child's vocabulary.

Again, the present study indicates that contributions to the development of a linguistic style may be indirect. Greater use of object labelling by the parent is not necessarily reflected in child speech or even in the interest the child shows in object labelling. As well, the greater interest in object labelling present during gross-motor activity was not reflected in a higher percentage of object labels in the child's speech, although the object label may appear in later speech. The indirect way in which linguistic interaction during a particular context may influence further language development makes it very difficult to map the way mother speech, child speech, and contextual environment interact to produce stylistic differences. McCabe's model, although taking an already complex, interactionist approach to language development, may still be too simplistic to be completely accurate.
Motor Development and Language Acquisition Style

It was necessary to manipulate experimentally the motor context in order to see whether, in fact, the language learning environment is affected by what the child is doing and it was found that different contexts resulted in different speech. However, it cannot be assumed that the child typically conducts himself or herself motorically at the same level as during this half-hour of play. Thus it was also necessary to measure the child's level of motor development in terms of his or her typical activity and compare that with his or her level of language development in order to test directly McCabe's (1989) and the present study's prediction that those who are at a lower level of language development but who are motorically advanced will have an expressive style of speech.

It should be noted that while the different contexts influenced the type of speech used, there should still be evidence of the child's preferred linguistic style. It was possible to classify the children's linguistic style based on the experimental speech sample. In fact, all the children but two were easily classified as expressive or referential.

Using MLU as an index of language development, there was no support provided for this hypothesis. Those in the Hi-Motor, Lo-MLU group were predominantly referential, contrary to expectations. As well, those in the Hi-Motor, Hi-MLU group were all expressive. Children with an MLU of 2.5 or more were left out of the analysis because of the increase in
pronoun use at this level, thus one cannot assume that this finding was a function of the child's higher MLU. However, it is possible that an increase in pronoun use was beginning at lower MLU levels in these children.

Using noun-type token ratio (NTTR) as an index of language development was more appropriate in this study because of the greater relation of size and variability of vocabulary to advanced language development than of MLU when discussing linguistic styles; expressive children would necessarily have an inflated MLU due to their preference for unanalyzed and formulaic phrases yet their language development is not necessarily very advanced. When this measure of language development was used, partial support was found for the present hypothesis. Two out of three children in the Hi-Motor, Lo-NTTR group used an expressive style of speech. Interestingly, the referential child in this group showed the strongest preference for a referential style; her noun use ratio was 90% nouns of all nominals. Perhaps such a strong preference for nouns overrode any influence of motor development on her style of speech. The Lo-Motor, Hi-NTTR group contained one referential child and one with a percent nouns/nominals of 51%. The other groups were mixed. Considering the vast number of other contextual influences on linguistic style (e.g., the presence of siblings, gender, socioeconomic status), this connection between motor development and linguistic style is quite impressive.
Methodological Issues

As always, there are ways in which a study can be changed or improved. A study can also provide suggestions for methodologies used in future studies as a result of present success with a particular measure or method.

One of the limitations of the present study was a confound in the use of toys. For example, because of the high interest in the Main Street toy, the context could be said to represent, not fine-motor play, but simply play with one particular toy. A pilot study with the toys may have avoided this problem; however, one can foresee a number of pilot studies being needed as it is highly likely that one toy will be intrinsically more appealing than the others in a group. As well, the Main Street toy had the advantage of keeping both mother and child engrossed in play, allowing the time to pass quickly for them and for the experimenter and videorecorder to be ignored. Finally, some time was usually spent with the other fine-motor toys and a small minority of children barely played with Main Street, so it is hasty to conclude that results arising from the fine-motor context are solely the result of one toy.

There was some evidence of preference for certain toys due to sex-typing, for example, the strong preference by boys for the hockey stick and ball. Most language studies will have some confound of toys; often language samples are obtained using the child’s toys which results in a vast
difference between subjects in toys used, but studies using experimentally-provided toys are somewhat more artificial and there is no guarantee that the children will have had the same previous experience with the toys. Replication using different toys would be desirable in order to determine whether the present confound is a seriously limiting one.

A second limitation was the wide range of MLU's found in this sample of children. Although it would be more costly and much more work, it appears desirable to prescreen children for more closely matched MLU's to obtain a more homogeneous sample. In particular, if examining early stylistic differences, it would be desirable to have children whose MLU is less than 2.5. The author's impression is that although some children preferring an expressive style have inflated MLU's, their lack of language sophistication does not allow an inflation over this mark.

This leads to a discussion of what measures are appropriate in studying language development. For some studies, MLU may be acceptable, but in others, a better index of language maturity should be used. Because of linguistic stylistic differences, MLU may be misleading as the expressive child may have an inflated MLU due to characteristics of this style. The decision to use a different index of language maturity in the present study, the child's Noun Type-Token Ratio, was prompted by the author's surprise at the placement of certain children in high and low language development
groups, especially as compared to some of the other children. For example, one young male was in the high MLU group, but his speech was quite inarticulate, and he grunted and squealed during most of the interaction. Yet when he spoke, he often used phrases such as "I want it", resulting in an MLU of 1.79. On the other hand, the girl who had the lowest MLU seemed far more adept in the use of language to make her wishes known and almost all her utterances were words. Her mother almost always understood her intended communication and they appeared to be having a conversation about the toys and what to do with them. While her vocabulary was not extensive, it was much more varied than that of the boy mentioned above. However, almost all her utterances were in one word, resulting in an MLU of 1.09. It may be desirable in future language studies to supplement MLU with other quantitative linguistic measures, and/or with some qualitative analysis, to determine level of language development.

Finally, if at all possible, videotaping the interaction is preferable for obtaining a language sample; in this study, more accurate transcription was possible because of the ease in seeing what the child was talking about. Videotaping also allows the experimenter to remember the context more easily, allowing more confidence in further analysis of the language samples at a much later date.
General Discussion and Conclusions

This study began with the question: "Is there a link between individual differences in motor and language development?" In particular, the individual differences in language development of interest were the presence of either an expressive or referential style of language acquisition and the associated difference in rate of acquisition in children using these two styles. The present study provides both a direct and indirect answer to this question. First, it was found that children who were at higher levels of motor development and lower levels of vocabulary maturity, which is related to rate of vocabulary acquisition, tended to use an expressive style of speech. Thus, a direct link between motor and language development was demonstrated. Unfortunately, this finding was based on only two out of three children who fell into this group and thus should be considered tentative at best until a larger sample of children who fall into this group are examined.

One might conclude that since the experimental manipulation of motor context is not of a developmental nature, this part of the study cannot address the issue of how development of a particular linguistic style is related to motor development. However, a child is going to find himself or herself in gross-motor and fine-motor contexts much like those in this study as he or she grows older. The demonstrated influence on the speech produced by mother and
child in such contexts will then likely influence the style of language acquisition the child will develop. Examining how this could occur provides an indirect answer to the study's initial question.

For example, it was found in this study that deictic pronouns, although not general pronouns, were used by the parent and child more often during motor activity in which the focus was on manipulating small parts. Since this type of play is one found more often in the older child than in the younger child (Leach, 1987), it is likely that a child who is more advanced motorically is hearing more deictic pronouns. If the child were still acquiring an early vocabulary, he or she may naturally incorporate deictic pronouns in his/her early speech, thus contributing to an expressive style of speech.

As well, a greater use of directives was found during the motor context which elicited much wandering by the child; more advanced gross-motor activity is typically accompanied by attempts to maintain physical proximity and these attempts, in this study, appeared to result in parental speech which, again, includes pronouns and which also focuses on the child rather than the object. Thus children who are more advanced in gross-motor development may well be hearing more pronouns and experiencing language as an attempt to control others. Again, if the child is at an early stage of vocabulary acquisition, a higher percentage of pronouns and a notion of
the purpose of language as a personal-social tool may occur, resulting in an expressive style of speech.

The effect of motor activity on linguistic interaction found in this study and its possible influence on the development of an expressive style supports specific predictions within McCabe's (1989) model concerning the influence of motor activity on speech and thus the importance of examining nonlinguistic contextual factors when looking for the source of individual differences in language acquisition. However, motor activity did not always affect speech as expected and thus complete support is not found for her model.

For example, manipulating small objects, although producing more deictic pronouns, also produced more object labelling. This occurred in a context which was more sedate than the gross-motor context; perhaps this somewhat resembles the book-reading context in which the mother can focus on the toy at hand rather than controlling the child's action. One might conclude that manipulating small parts would therefore contribute to the development of a referential, rather than an expressive, style of speech if it occurred at an earlier stage of vocabulary acquisition. However, unlike a book-reading context, shared attention was not always present. Particularly with Main Street, mothers often labelled for the child while the child was busy with some other aspect of the toy. Children did not use more object labels during fine-
motor activity and in fact, responded more instead to object labels provided during gross-motor activity.

As well, McCabe’s predictions that child and mother will produce language in accompaniment is not fully supported. The prediction was supported in the case of deictic pronouns, but not for object labelling. While the possibility exists that the influence of the mother’s speech will be felt at a later date in the child’s life, another interpretation can be provided. It appears that while the child is being influenced by what the mother is saying to him or her, he or she is also contributing independently to the linguistic interaction. Stronger evidence for this is found in the greater responsiveness of children to their mothers’ object labels during gross-motor play, even though mothers provided fewer opportunities for responding. If this interpretation is correct, it provides support for McCabe’s interactionist approach in which the child, along with parents and the contextual demands, contributes to the development of a particular linguistic style.

Further support for McCabe’s interactionist model is found in the strong influence of contextual demands on the linguistic interaction. The finding that different motor activities led to a variety of different speech illustrates the importance of examining the context in which the child is learning language. As well, the finding, though tentative, that a higher level of motor development along with a lower
level of language development is associated with an expressive style of speech suggests that nonlinguistic contextual variables may be influencing linguistic style preferences. Research should take place to examine the relationship the other nonlinguistic contextual variables, as well as motor development, have on the development of linguistic styles. Not only would this provide some insight as to how these combine with each other to influence the child’s language acquisition, it would also shed further light on the question of how salient a child’s level of motor development is in influencing other areas of development.

Finally, McCabe’s model, although an interactionist one, may still be too simplistic. The present study indicates the strong possibility that influence by mother, child, and context may be more subtle and indirect than the model proposes, thus making it difficult to examine how these influences are being felt. The assumption that motor ability is tied to age may not be accurate; motor development could be related to other factors, such as socioeconomic status and preference of certain toys due to sex-typing. In fact, it is highly likely that the nonlinguistic contextual factors which she examines are very confounded with each other. For example, males may be more likely to be encouraged motorically, resulting in slightly advanced motor skills while the child is still acquiring his early vocabulary. Laterborns may be more or less advanced in motor development and/or self-
help skills, depending on the age spread between siblings. Older siblings may do more for the child, or conversely, could encourage the child to daring physical feats, while a younger sibling would perhaps promote the baby to fend more for himself or herself, if a mother has to contend with two young, dependent children. However, before getting hopelessly entangled in even more complex possibilities, it is important to remember that simply including nonlinguistic contextual factors in accounting for language development is quite new. McCabe’s model provides a starting point for that purpose.

In conclusion, in keeping with the beginning trend in psychology away from solely focusing on the mother’s influence on the child, this study looked at both mothers’ and children’s contribution to the linguistic interaction, as well as, the contextual influences on their speech. The results of this study strongly suggest that all three must be examined in order to get a fuller picture of the child’s language learning environment. This study is the first to evaluate McCabe’s (1989) model accounting for the development of an expressive or referential style of speech. The finding that just one aspect of the nonlinguistic context, motor activity, results in different speech and tentatively appears to influence the adoption of a particular style of language acquisition is exciting and provocative. It is clear that we must look beyond the linguistic environment to the nonlinguistic
environment to discover the source of individual differences in language acquisition.
REFERENCES


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Lieven, E.V.M. (1978). Conversations between mothers and


APPENDIX A

SAMPLE PARENT LETTER
Dear Parent(s),

My name is Theresa Morris and I'm a graduate student in child psychology at the University of Windsor under the direction of Dr. Ann McCabe. I'm conducting a study on language and motor development in children aged 18 to 30 months. If you volunteer to take part, I will meet with you and your child in your home at a time convenient for you. Your participation would consist of answering some questions about your child's motor development and then playing with your child for about half an hour with some toys I will bring along. This would be videotaped in order to eliminate the need for hand recording. Videotapes will be kept completely confidential. In all, it would take about an hour.

If you would like to participate, or have any questions, please call me at 944-0287. Thank you!

Sincerely,

Theresa Morris

Ann E. McCabe, PhD.
APPENDIX B

RAW MOTOR AND LANGUAGE SCORES
### Table 8

**Raw Motor and Language Scores**

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APPENDIX C

INTERRATER RELIABILITIES FOR CODING BY CATEGORY
### Table 9

**Interrater Reliabilities for Coding by Category**

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<th>Category</th>
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<tr>
<td>1962</td>
<td>Born in Ottawa, Ontario to Leonard and Willena Arsenault.</td>
</tr>
<tr>
<td>1984</td>
<td>Graduated with the degree of Bachelor of Arts, (Honours) in Psychology, St. Francis Xavier University, Antigonish, Nova Scotia.</td>
</tr>
<tr>
<td>1988</td>
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