DOCUMENT RESUME

ED 261 545 FL 015 213

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TITLE Learning Strategies in Two Danish Children's Language Development.
INSTITUTION Stanford Univ., Calif. Dept. of Linguistics.
PUB DATE Aug 85
NOTE 12p.; Papers and Reports on Child Language Development, Volume 24, p105-14, Aug 1985. For related documents, see FL 202-212 and 214-17. GEO-Denmark
PUB TYPE Reports - Research/Technical (143)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Case Studies; Child Language; *Cognitive Development; *Individual Differences; Infants; *Language Acquisition; *Learning Strategies; Longitudinal Studies; *Social Development; Toddlers

ABSTRACT

A longitudinal study, intended to produce a profile of the relationship between cognitive, social, and linguistic development in Danish children, had as subjects a boy and a girl aged 11 and 8 months, who were observed until they reached age 3. Naturalistic language used by the children and their parents, videotaped during regular visits, was analyzed for utterance length and vocabulary and for changes in these factors over time. Significant individual differences could not be explained by simple applications of cognitive theory. Application of a theoretical framework that distinguishes between analytic and holistic processing strategies to explain similarities and differences between the children puts into question the surface validity of some of the objective measures used in language development research. It is suggested that individual differences in development demand a more refined approach than the generalist approaches used in recent years. (MSE)

PRCLD 24 (1985)

LEARNING STRATEGIES IN TWO DANISH CHILDREN'S LANGUAGE DEVELOPMENT

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INTRODUCTION

Projekt Barnesprog is a longitudinal investigation of two Danish children's linguistic, cognitive and social development. The main purpose of the study is to establish a profile of young Danish children's language development in relationship to their developing cognitive and social skills using the techniques of developmental psycholinguistic analysis. The following pages describe a preliminary analysis of the data collected during the first half of the study. It will become evident that the attempt to establish a profile of language development for the Danish child is not a straightforward matter. Even with a sample of just two children, individual differences in development demand a more refined account than the generalist approaches prevalent during the seventies.

METHOD

The study began when the two children - a boy and a girl - were $11\frac{1}{2}$ months and $8\frac{1}{2}$ months old respectively. Data collection continued until both children were 3 years old. The girl has a sister who is $2\frac{1}{2}$ years older. Both parents had completed a university education. The boy is a single child. The father is a skilled worker and the mother had just started on a university education. Both children have spent a good deal of time in nursery school. The children were visited in their homes fortnightly. Each visit consisted of an Interview, Testing Procedures and a Free Play Session. The interview focused on the parents' observations of their child's language behaviour since the previous visit; whether any new words had emerged; whether the child had begun using old words in new ways; whether the child's social and communicative skills had developed in any way; finally, any other noteworthy developments the parents may have observed. To this end, the parents were asked to keep a diary of the various aspects of their child's development on a week-to-week basis. The contents of the diary formed the basis of much of the discussion in the interview session. The testing procedures were taken from the Uzgiris-Hunt (1975) Infant Assessment Scales. The rationale for these scales is based on Piaget's (1953) theory of the sensorimotor period. The object permanence and means-ends sub-scales were administered on each visit. The remaining sub-scales were administered less frequently. In the final free play session, parent and child were encouraged to engage in a variety of social situations. An attempt was made to establish some regularity in the kind of situations observed across visits (feeding time, solving a

problem together, story-telling). However, importance was attached to collecting naturalistic data and so coercion was avoided. The entirety of each visit, which lasted approximately $1\frac{1}{2}$ hours, was recorded on video-tape. Radio-microphones were used to collect the vocal data from child and parent.

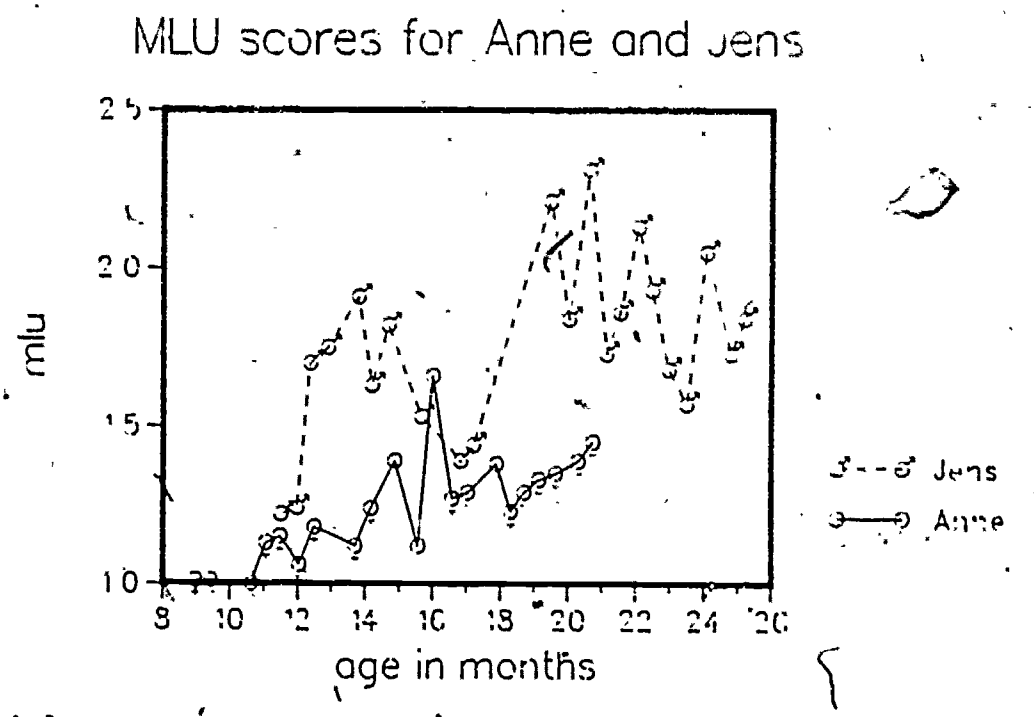
After the visit, a transcription was made of the video tape. A standard orthographic transcription was made of all the verbal behaviour during the session together with a transcription of any non-verbal activity that might aid in the interpretation of the verbal behaviour. The speech of all participants was analysed into utterances after Snow's (1972) guidelines. On this view, utterances are not defined in terms of adult grammatical structures like the sentence but according to the pauses and intonational patterns in the dialogue. Utterances were then analysed into morphemes. For children this can be a problematic process. For example, "What is that" may be uttered by the child as a single undifferentiated formula. In such cases, utterances are coded as containing only a single morpheme. The rule of thumb we use for deciding the morphemic breakdown of an utterance is that all the potential morphemic components must occur productively in combination with other components in the corpus of the child's speech. "Other components" includes the null component where the morpheme is used alone.

The coded transcriptions are then stored on magnetic tape for further analysis by computer. A programme has been developed for calculating measures of language behaviour like Vocabulary Score and Mean Length of Utterance (MLU). Vocabulary score is simply the number of different sounds used by a particular speaker for meaningful communicative purposes on each session. No attempt is made to distinguish between adult-like lexicalised words (e.g. "doll") and idiosyncratic non-lexicalised sounds (e.g. "ayah"). In the present analysis, these idiosyncratic non-lexicalised sounds have been attributed the status of morphemes on the sole criterion that they are used for meaningful communicative purposes. No claims are being made concerning their relation to the adult morphemic system. MLU is a crude measure of language complexity based upon the average number of morphemes expressed in each of the speakers' utterances. It is generally regarded as a useful guideline in establishing a child's level of linguistic development up until the age of 4 years.

RESULTS

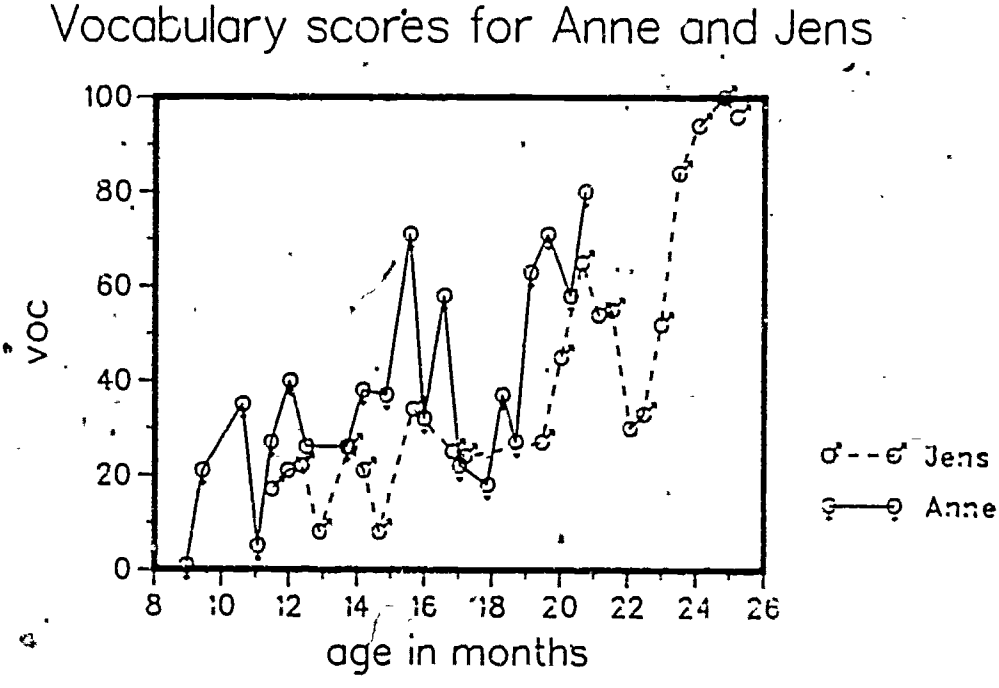
MLU. Figure 1 summarises the MLU scores for Anne and Jens. Anne has a fairly traditional developmental profile during her second year. Until 16 months her utterances consist mainly of single morphemes. Thereafter, a sudden spurt takes her into a multi-morphemic stage. In contrast, our male subject Jens has a rather unusual MLU profile. The high level achieved by 13 months is followed by a 4 months' decline before growth in MLU reestablishes itself. Nevertheless, statistical analysis confirms that Jens' MLU correlates positively with age ($r = 0.49$, $p < 0.05$) though this tendency is much clearer in the case of Anne ($r = 0.77$, $p < 0.01$).

FIG. 1



Vocabulary Scores. Figure 2 summarises the vocabulary scores for Anne and Jens. The profile of development for both children follows the pattern reported by many other studies, namely a slow growth

FIG. 2



during the early stages of language development followed by a sudden explosive-like increase in vocabulary. The timing of vocabulary growth is different for the 2 children. Anne is roughly 3 months in advance

of Jens. As might be expected, vocabulary scores correlate positively with age for both children ($r = 0.66$, $p < 0.05$; $r = 0.83$, $p < 0.05$ for Anne and Jens respectively). However, it is noteworthy that the 2 children suffer a regression in their vocabulary scores after an initial spurt in growth.

Comparing vocabulary scores with MLU reveals a clear positive correlation ($r = 0.37$, $p < 0.05$ for Anne, $r = 0.28$, $p < 0.1$ for Jens), a correlation which remains even when age is partialled out of the analysis. Furthermore, the most pronounced increases in MLU occur at the same time as the children achieve a vocabulary score of about 50. This result replicates Nelson's (1973) finding based on 18 English-speaking American children. Notice, however, that, despite the overall positive statistical correlation between MLU and vocabulary score, MLU shows a substantial increase during the period when vocabulary scores show a regression.

Cognitive Development. Table 1 summarises the ages at which the 2 children master various levels of development on the object permanence and means-end sub-scales of the Uzgiris-Hunt infancy assessment scales. Mastery of stage 5 of object permanence indicates that the child is able to retrieve an object which has been "visibly" hidden from him in a succession of locations. Stage 6 (transition) indicates the beginning of full object permanence as exemplified in being able to retrieve an object which is "invisibly" hidden under a cloth. Stage 6 represents the achievement of full object permanence, i.e. the child can retrieve a hidden object after successive "invisible" displacements. Mastery of stage 5 of means-end relations indicates an understanding of instrumentality, e.g. grasping a string to retrieve a toy to which the string is tied. Stage 6 requires a higher level of insight for the solution of a means-end problem, e.g. using a stick to retrieve an object which is otherwise out of reach. The stick task should be more difficult because it is possible to see a string that is attached to an object as an extension of that object whereas the child must anticipate the relationship between two spatially separate objects in the case of the stick and the toy. Furthermore, children are likely to have had some experience with strings attached to toys and to have solved this problem using trial and error before the test session.

TABLE I

	AGE OF ATTAINMENT (in months)				
	Object Permanence			Means-End Relations	
	Stage 5	Stage 6 (transition)	Stage 6	Stage 5	Stage 6
Jens	12½	16½	19	12	16½
Anne	9	14	20	8½	(13) 16

( ) indicates only a single successful attempt at task.

The children's performance on these tests confirm Uzgiris & Hunt's claim that their assessment tasks represent an ordinal scale of cognitive development. Both children mastered the tasks in the sequence specified by the scales. Furthermore, ages of attainment of the different stages of development on the 2 sub-scales reveal a consistency across the scales. For example, achievement of sensorimotor stage 5 on the object performance sub-scale occurs roughly at the same time as the children reach sensorimotor stage 5 as measured by means-end relations. This points to the validity of the tasks used on the different sub-scales to measure a child's level of sensorimotor development. These results also suggest that stage 6 of means-end relations describes a level of cognitive development more akin to stage 6 (transition) of object permanence than full object permanence. Unfortunately, the uncertainty surrounding Anne's age of attainment of stage 6 on the Means-End Relations scale makes interpretation difficult. It must also be mentioned that the age quoted for Anne's mastery of stage 6 of object permanence is to be viewed with suspicion. Over a period of several months prior to demonstrating a competence for finding objects after successive "invisible" hidings, Anne refused to cooperate in the testing procedures. The figure of 20 months must be regarded therefore as a rather conservative estimate of Anne's achievement of full object permanence. With the exception of this last stage of object permanence, Anne's performances on the scales are consistently in advance of Jens'.

Comparison of Language and Cognitive Measures. Bates (1976) has argued that the operations underlying sensorimotor stage 5 of cognitive development are a necessary prerequisite for the intentional, communicative use of language. In Piagetian terms the ability to act in an intentional manner is described in terms of the degree to which the child is able to distinguish the "means" from the "end". Thus, purposively grabbing hold of a string to obtain an object which is otherwise out of reach is seen as a sign of intentional, instrumental behaviour. Bates proposes that intentional communication, the verbal analogue of instrumentality, should emerge together with its corresponding sensorimotor skills.

In the present study, Jens was in possession of a substantial vocabulary (about 20 words) before he demonstrated a mastery of Sensorimotor Stage 5. This suggests that he was using words communicatively as a means for achieving certain ends before he demonstrated the parallel but more object-oriented skill of using concrete tools as a means for achieving certain ends. On the other hand, Anne had mastered sensorimotor stage 5 before she began to develop a vocabulary. Bates et al. (1977) have pointed out that variations of this kind between children are not unusual in sensorimotor development and suggest that they may reveal an individual tendency to either socially-oriented or cognitively-oriented learning styles. Insofar as word-use represents a person-oriented, social application of the means-end operation and tool-use represents an object-oriented, cognitive manifestation of the same underlying skill, we see at the beginning of the study a bias in

Jens to more socially motivated acts whilst in Anne a bias to more cognitively motivated behaviour.

Sensorimotor stage 6 is typically interpreted as the stage in cognitive development when a Symbolic Capacity is first manifested. Indeed, Piaget (1926) has argued that the emergence of language, a symbolic skill par excellence, is dependent upon the child's mastery of a more general symbolic capacity which also underlies full object permanence. Corrigan (1978) has carried out a careful study of the relationship between language development and object permanence. Although she found no direct correlation between children's level of object permanence and general linguistic measures like MLU, she did find that the greatest increases in vocabulary growth did not occur until or after the children had achieved stage 6 of object permanence. In the present study both Anne and Jens show a similar pattern of development to Corrigan's subjects. It should be noted that Anne is quicker to translate her cognitive gains into increases in vocabulary. For Anne, mastery of stage 6 (transition) accompanies substantial increases in vocabulary. On the other hand Jens' vocabulary explosion, like Corrigan's, Ss does not occur until he attains full stage 6 object permanence.

DISCUSSION

MLU. One of the most unusual findings of this study concerns Jens' profile of MLU development. At 12 months, Jens' MLU has a value of 1.2. This implies that a small proportion of his utterances already contain more than one morpheme; a highly unusual finding for a child of so young an age (cf. Corrigan's study where the average age for the achievement of an MLU of 1.2 is 19 months). Furthermore, before Jens has reached 13 months his MLU has reached a level of 1.75, implying that most of his utterances are multi-morphemic. (Again these measures can be compared with other studies like Brown (1973) where such levels of MLU are not usually reported until the end of the child's second year). Of course, it may be the case that Jens is a particularly precocious child. Such cases are not unknown in the history of child language research. However, Jens' rather low vocabulary scores and 4 month long regression in MLU lead one to doubt this interpretation. A more compelling explanation can be found by considering qualitative aspects of Jens' language usage and problems surrounding the morphemic analysis of young children's early utterances.

Jens' use of language in the early months of the study can be described as "Expressive"; a term used by Nelson (1973) to characterise a child who uses language mainly for social purposes rather than "Referential" purposes. A typical property of expressive language is that it resembles adult speech in its surface structure. Thus expressive children tend to produce more sentence-like utterances than referential children whose language is dominated at an early stage by one-word utterances. In attempting to analyse the sentence-like forms of expressive children, one has to decide whether the adult-like surface structures they use reflect adult-like deep structures. In the context of morphemic analysis this involves deciding whether utterances like "What is that?" should be attributed three morphemes or one. From an adult perspective there is no problem in decomposing

these utterances morphemically. However, the same sound-morpheme mapping may not be valid when analysing the child's language. Nelson (1981) has expressed the view that at an early age, utterances like "What is that?" may be used as social formulas by the child for the achievement of particular social/communicative functions. On this view, these utterances have no internal morphemic structure and so in MLU counts should only be attributed a value of one.

It will be recalled that our rule of thumb for deciding the morphemic breakdown of an utterance is that all the potential morphemic components must occur productively in combination with other components in the corpus of the child's speech. Thus, for the utterance "What is that?" to be attributed a score of 3, its component morphemes must each occur in other linguistic contexts. Unfortunately, this rule of thumb does not rule out the possibility that these types of expression are still learnt as single, unanalysed wholes despite the fact that their apparent morphemic constituents are productive in other linguistic contexts. Bretherton et al. (1983) have suggested that individual differences in language acquisition may be the result of different learning strategies. They name a holistic processing strategy which often includes "the acquisition of whole unanalysed phrases whose components are often not clearly intelligible" (ibid. pp. 311). Our subject Jens may be using such a holistic strategy to a greater degree than is the norm in early language acquisition. However, use of a holistic strategy does not rule out the simultaneous exploitation of an analytic approach to language learning. The analytic approach is often associated with the acquisition of individual names for object and events and the subsequent productive combination of these nominals. The combined use of two such strategies can account for Jens' unusual MLU profile. An analytic strategy will give rise to morphemic components being attributed productivity in the process of data analysis. If this strategy is utilised concurrently with a holistic strategy in which some utterances are learnt as unanalysable wholes and these wholes contain components which have elsewhere been attributed productively, then an artificially inflated value of MLU will result. Furthermore, Jens' regression in MLU can be interpreted as a shift in language processing strategies. Nelson and Nelson (1978) have proposed that an important dynamic in language development is the interplay within the individual child between cognitive/analytic strategies and social/holistic strategies. The relative dominance of one strategy over the other need not be constant throughout development but may shift in a pendulum-like motion. It appears that Jens' holistic strategy goes underground during the regressive period, leaving the analytic process as the dominant language strategy. The absence of holistic, unanalysed phrases like "What is that?" result in a reduction of MLU. It is also noteworthy that Jens makes significant cognitive developmental advances during this period.

Anne's early language usage corresponds closely to what Nelson (1973) has called Referential language. Her early utterances do not contain the adult-like social formulas typical of Jens' language. Rather they consist of individual morphemes closely related to words taken from an adult model. Increases in MLU for Anne are the result of productive combination of these individual morphemes. In this respect,

Anne appears to be using a predominantly analytic language processing strategy.

It is worth emphasising that the dimensions of individual variation mentioned in this discussion do not appear to be independent of each other. A number of authors have recognised that the so-called referential style of language tends to be used by children who are characterised as cognitively oriented and analytic in their processing strategies. Similarly, expressive language users are often holistic and social in orientation. The present study is no exception to this pattern. Indeed, our two subjects seem to be amongst those children who best fit the pattern, i.e. those found near the poles of the dimensions of variation. Our interpretation of the MLU results have identified Jens as a predominantly holistic language processor whilst Anne's style is analytically oriented. We have also seen that Anne is consistently in advance of Jens in cognitive development as measured by the Uzgiris-Hunt assessment scales. Furthermore, Jens is decidedly more socially oriented in his language use than Anne. For Jens, language is a tool for personal interaction whereas Anne seems to use language more as a cognitive tool for categorising the world.

Vocabulary Scores. Anne's cognitive orientation relative to Jens can also be seen by considering the two children's pattern of vocabulary growth. Both children undergo an explosive growth in their vocabulary after a period of relatively slow development. However, Anne's spurt takes place some 5 months before Jens'. McShane (1979) has suggested that the sudden increase in vocabulary often observed during the second half of the second year is due to the child's sudden insight into the fact that objects, events and relations can be named. This interpretation is based on the finding that these explosive-like increases can be attributed almost entirely to an increase in the number of nominals in the child's vocabulary. This interpretation is supported by our own finding that the vocabulary explosions occur at the same time as Jens and Anne master stage 6 and stage 6 (transition) of object permanence respectively. According to Piaget (1945), mastery of object permanence marks the development of a general symbolic capacity which in turn is an important contribution to the child's discovery that objects, events and relations can be named. The similarity in time of onset of a differentiated vocabulary and developments in object permanence points to the influence of a general symbolic development on vocabulary growth. Vocabulary growth is thereby interpreted as being a result of the symbolic discovery that objects can be named. The later development of a differentiated vocabulary in the case of Jens fits our characterisation of the two children as socially and cognitively oriented respectively. A child who is more concerned with the expressive, social functions of language will have less need for a differentiated vocabulary of nominals than a child who is more engaged in talking about objects, events and physical relations.

However, the two children's profile of vocabulary development leave a number of unanswered questions. First, if object permanence is a prerequisite to the child's discovery that objects can be named and hence the explosive-like increase in vocabulary, why does this increase occur at the onset of stage 6 (transition) for Anne but not until stage 6 for Jens? Second, why is there a regression in the two

children's vocabulary immediately following the initial explosive growth?

The answer to the first question is unclear though several possibilities suggest themselves. Mastery of stage 6 (transition) of object permanence may mark a sufficient development of a general underlying symbolic capacity for accelerated vocabulary growth to begin. However, fulfilment of a sufficient condition does not guarantee that the related development will occur. A development which meshes well with a child's general style of functioning is more likely to be exploited than a development that does not. Anne's analytic orientation places her better to utilise a developing symbolic, cognitive capacity than Jens for whom social considerations are predominant. However, why does Jens seem to await the mastery of full object permanence before developing a more differentiated vocabulary? Recently, several authors (Tomasello & Farrar, 1984, Gopnik & Meltzoff, 1984, McCane & Nicolich, 1981) have argued that although the development of object permanence is not related to general measures of linguistic development, specific items in the child's vocabulary depend upon the attainment of a given level of object permanence. For example, Tomasello & Farrar present evidence that the word "move" requires stage 5 of object permanence whilst "allgone" is not used by the child to imply that an object has disappeared until stage 6. Suppose that a given type of word which matched a child's dominant communicative style required the attainment of full object permanence. Emergence of a differentiated vocabulary with respect to this type of word would not occur until stage 6 had been mastered. On the other hand, if the given type of word only required the mastery of stage 6 (transition) then the differentiated vocabulary could emerge earlier. In other words, the timing of emergence of a differentiated vocabulary depends upon the preferred mode of language functioning in any given child and its interaction with the child's level of cognitive development. We can only speculate here that Jens' social/expressive/holistic model of language functioning directs him to that portion of the adult lexicon which requires the attainment of full object permanence whilst Anne's cognitive/referential/analytic mode of language functioning selects vocabulary items that can be supported adequately by stage 6 (transition). Of course, any final conclusion regarding this hypothesis awaits a more detailed analysis of the two children's word usage.

One final aspect of the language data for our two children warrants further discussion, namely the regression in vocabulary scores after the initial spurt of accelerated growth. The regressions seem too prolonged ($2\frac{1}{2}$ months for Anne and $1\frac{1}{2}$ months for Jens) to be explained away as random pertubations in the data. Furthermore, MLU measures for both children show substantial increases during these periods of regression. It is not unreasonable to suppose that these two developments, increase in MLU and reduction in vocabulary, might be related. The discovery that objects, events and relations can be named makes possible the linguistic expression of semantic relations holding between entities and events in the environment. Thus, McShane (1979) has noted that vocabulary explosions are often closely associated with the emergence of two-word utterances. This would account for the general positive correlation between vocabulary scores and MLU. We might con-

ceive the reductions in vocabulary scores as a result of the sharing of cognitive resources between the two processes of vocabulary growth and syntactic development, i.e. MLU advances at the expense of vocabulary growth. A limited vocabulary of salient words may be selected by the child as the foundation for exploring the combinatorial possibilities of its linguistic system. It is interesting to note that a strategy of this kind during a period of restricted vocabulary usage would give rise to the kind of distributional phenomena described by the pivot-open grammarians writing during the sixties (Braine, 1963). These grammars were written mostly for children in the initial period of the so-called two-word stage. The period of restricted vocabulary usage for our own two children also coincides with their early attempts to combine individual morphemes.

CONCLUSION

It is a current trend in child language research to account for individual differences in language acquisition in terms of the application of different strategies to the learning process. In the present account, I have attempted to use the distinction between analytic and holistic processing strategies to explain a variety of similarities and differences between the two children investigated. The postulation of these two strategies is, of course, a hypothetical business: We have no independent evidence that identifies the children as having a preferred strategy.

We have seen how this theoretical framework forces us to question the surface validity of some of the objective measures used in language development research. For example, the interpretation of a child's MLU is seen to be dependent upon the particular language processing strategy the child is using. Nevertheless, the MLU profile itself can yield clues as to the strategy being applied. In this context, regressions can be especially informative (cf. Bever, 1982). Similarly, vocabulary scores need to be evaluated in terms of the child's preferred mode of language functioning. Cognitive developments will be exploited in the child's vocabulary growth only to the extent that the child's social and cognitive needs are thereby fulfilled.

An outstanding problem for this theoretical approach to child language acquisition is the elucidation of the relationship between the referential form and the cognitive functioning of language, and between the expressive form and social functioning of language. The notion of an analytic processing strategy goes a considerable way to elucidating the referential/cognitive form/function relationship (see Nelson, 1981). It is not so clear how the notion of a holistic processing strategy might explain the expressive/social form function relationship. It is hoped that a more detailed pragmatic analysis of the children's early language will illuminate this finding.

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