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PREFACE

My studies are part of the psycholinguistic research done at the department of psychology at the University of Jyväskylä. Under the leadership of Professor Isto Ruoppila I have got acquainted with problems related to the development and learning of Finnish morphology. I should like to acknowledge my indeptedness to him for the fact that my participation in his studies has given me an insight into this field of research and the possibility to get support and advice at various stages of my research work. I am indebted to Dr. Brian MacWhinney from the University of Denver and Dr. Jorma Kuusinen for their invaluable comments on my studies. I should also want to express my gratitude to Professor Martti Takala for his advice and encouragement assisting the completion of my work.

My thanks are also due to the personel in the kindergarten and children's clubs and the children who by participating in my studies have decisively influenced the successful realization of my studies. I also wish to thank Mrs. Riitta Käyhkö, Mrs. Elisa Hirtolahti-Valve, Mrs. Raili Leutonen and Mrs. Leila Hoikkala for their help in collecting my research data.

In particular, I should like to express my gratitude to my husband Heikki Lyytinen, whose unfailing support and critical comments have influenced my way of analysing and reporting the studies. The research field was made interesting by our little daughter Anu, who, when learning to speak, has made concrete to me the central concepts in the cognitive theory of development and thus motivated me to analyse in more detail the factors which could be influenced and which could give

better opportunities for all children to learn and use their native language.

My thanks are also due to Mrs. Arja Keltomäki for translating my manuscript into English, Mr. Anthony MacDougal for checking the text, and Mrs. Arja Salminen for typing my work.

When performing as a research assistant of Finnish Academy in 1972-1975 I have had the opportunity for full-time research work and for the realization of my studies, my gratitude to Finnish Academy.

Finally, I wish to express my thanks to the University of Jyväskylä for accepting my report to be published in the series of 'Jyväskylä Studies in Education, Psychology and Social Research'.

Jyväskylä, December 1977

Paula Lyytinen

CONTENTS

1. INTRODUCTION

The mastery of the mother tongue is important to a child for many reasons. Language bears a connection with cognitive skills, such as a child's thinking, the planning and regulation of behaviour as well as his emotional and social communication. Through language a child organizes his visual world in a new way, gets acquainted with his environment, obtains and receives information. Language is closely related to learning even at the earliest stage of development. Later, during the school years, the relationship between language and learning is even closer.

Language acquisition can be examined by observing how a child masters any one of a number of linguistic systems: phonetics, vocabulary, or the rules of word inflection and sentence formation. The studies to be presented analysed the acquisition and the mastery of Finnish morphology in 2- to 5-year-old children. This was realized by examining the influence of deliberate training and the importance of the environment on the acquisition of inflections.

Morphology means the level of linguistic structures at which stems and inflections are combined to form words (MacWhinney 1978). The study of the development of morphology in a child's speech offers means for discovering the processes with the help of which a child handles linguistic data. The examination of these processes at the different levels of development also reveals facts about language acquisition in general. Especially the mastery of the inflections of the mother tongue is important because it is easy for a child who masters morphological forms well in his spontaneous speech to transmit these

skills to reading and writing at the beginning of school.

The first study by the present author (Päivinen 1972) examined the short- and long-term effects of training on the mastery of morphology among 3- to 5-year-old children. Study 2 (Lyytinen 1974) compared the influences of different training programmes on the acquisition of inflections in 4-year-old children. These first studies were concerned with examining the effects of deliberate training in language learning including such independent variables as amount and type of training as well as association value of the stimulus words. They also helped to answer some questions left unanswered in earlier studies of learning the Finnish morphology by Luukkonen & Ruoppila (1969) and Ruoppila (1972).

It was found in the analysis of the learning results that there was variation within and between the age-groups besides in correct performances also in the types of erroneous responses. This raised the question of what role the erroneous inflections and incompletely inflected stems have in the process of learning the morphology. To examine this question, study 3 (Lyytinen 1973) analysed the linguistic errors of 3- to 5-year-old children and examined the connections between them and some variables describing the children's cognitive level of development.

A potential source of variability in the children's linquistic and cognitive skills within their age-group is related to environmental effects. Wachs, Uzgiris & Hunt (1971), Jones (1972), Clarke-Stewart (1973) and White & Watts (1973) have published evidence about this relation. The fourth study (Lyytinen 1975, 1976) included an attempt to examine this broad problem-area by analysing the relations between the mother-child interaction and the linguistic and cognitive skills of 2-year-old children. This study sought to specify the factors influencing the acquisition of morphology and thereby to explain the individual differences observed in the early linguistic skills of children.

One criterion for the choice of research problems was their applicability to the planning of early childhood education. The studies have also been motivated by the wish that information could be acquired with which environments could be changed into favourable ones

as regards language acquisition and a child's total development. The first study was directed by a learning-theoretical orientation. The results of that study profoundingly modified the authors' ideas about the global character of linguistic skills and led to an increased emphasis on the cognitive approach in further studies.

2. THE COGNITIVE THEORY OF DEVELOPMENT AND LANGUAGE LEARNING

The cognitive approach to language learning first became prominent in the early 1970s. This approach has been guided in part by Piaget's cognitive theory of development which has offered a new, more total approach to the description of child development. The central idea of the theory is that child development proceeds gradually from one level to another. The order of the levels is the same for all children but individual variation can appear in the speed of acquisition of those skills characteristic of a given level. The cognitive theory of development does not explain separately the acquisition of language and its morphological and syntactic rules. Linguistic skills are considered as one form of representation and the mastery of those skills is closely connected with the other parts of cognitive development.

In the last few years attempts have been made to widen the cognitive theory to include a more detailed analysis of the stages in language learning. Together with her fellow researchers (Inhelder & Sinclair 1969, Ferreiro & Sinclair 1971, Cambon & Sinclair 1974, Inhelder, Sinclair & Bovet 1974, Papandropoulou & Sinclair 1974), Sinclair (1970, 1971, 1973a, 1973b, 1975; Sinclair-de Zwart 1969, 1972, 1974) has done much to extend Piaget's views to language development. At the same time she has made experimental studies clarifying the theory. Further empirical and theoretical observations on language acquisition from the viewpoint of the cognitive theory have been presented by Bloom (1970), Herriot (1970), MacNamara (1972), Brown (1973a), Slobin (1973), Cromer (1974), Morehead & Morehead (1974), Beilin (1975), Bruner (1975, 1977), Moerk (1975), Greenfield & Smith (1976), and others.

The starting point in the theorizing of the school of Genova is

the idea that during the first eighteen months of his life a child is in active interaction with his environment and the people in it and that through this interaction he acquires cognitive structures which are not only the basis for language acquisition but also for acquiring information about such concepts of the physical environment, as time, space, gravity, and concepts of logical-mathematical relationships and categories. According to Piaget (1955), these different types of concepts have roots in the preverbal sensorimotor period actions. Piaget supposes also that these concepts are universal, so that the order of concept acquisition and the cognitive operations needed are the same with all children, although the speed of acquisition and the complete form of mastery can vary from one environment to another. Acquisition of these concepts is not merely a passive copying of adult models, but an activity in which a child analyses his environment and tries to change it through his own actions (Sinclair 1973a, 1975).

Language implying meaningful representations is dependent on cognitive functions (Sinclair 1975). Cognitions are considered necessary but not solely sufficient presuppositions for language learning. According to Sinclair (1975) 'intellectual development is possible without language, but language acquisition is bound to the elaboration of cognitive structures is general'. Language is a productive system in which words are combined according to rules. The application of these rules to new situations is in itself a cognitive activity (Sinclair 1971, 1975).

Learning to speak presupposes a normally-developed central nervous system, adequate development of motoric and perceptual skills and environment in which a child has opportunities to hear and use language (Sinclair 1973a). Language acquisition seems to bear a closer connection with an exterior model than cognitive development (Sinclair 1975). Slobin (1973) emphasizes that a child has certain operating principles in language acquisition regardless of the peculiarities of the particular language he is acquiring. E.g., the child's active attention to the speech acts in his linguistic community and his consequent ability selectively to produce the speech heard and to create rules, has been regarded as universal to all children (Slobin 1970, 1973; Sinclair 1973a).

According to Sinclair (1971, 1973a, 1973b, 1975) the central preverbal cognitions connected with language learning are the progressive integration and differentiation of action- and thought patterns; the achievement of object permanence; distinguishing between agents, actions, and their objects; and the representation of the reality by images preserved in the mind. The mastery of object permanence means that objects no longer cease to exist when they disappear from the child's immediate visual field. Representation presupposes that a child recognizes the objects and events in his closest surroundings and knows what the symbols represent. Representation originates in imitation which begins during the sensorimotor period and progresses under the influence of general cognitive development. Representation also means that a child's play becomes symbolic. In his play a child replaces some activities with others and transmits the activities - the object of which he has recently been - to others (e.g., feeding a doll with an empty spoon, replacing the spoon with some other thing etc.).

The mastery of the above described preverbal activities makes it possible, among other things, for a child during his second year to be capable of anticipating events temporally and locally and also capable of deferred imitation - in other words of imitating objects not present. The integration and differentation of action-patterns, the concept of object permanence, distinguishing between action and its object are mastered before the emergence of speech production. Representational activities appear in child behaviour when he has reached the final stage of sensorimotor period (Sinclair 1973b, 1975).

2.1. The acquisition of morphological forms

Preverbal activities related to language acquisition can be observed in child behaviour as early as at the age of 4-8 months. During that time a child learns to grasp things and to handle them. In the first stages of sensorimotor development a child does not differentiate between action, object and subject (Sinclair 1975). By performing

the same activity with different things (by shaking a rattle, a doll, a spoon) and different activities with the same thing (by shaking, turning, rapping a block) he learns to distinguish between actions and their objects (Sinclair 1973a, 1975). At the end of his first year a child is capable of combining action-patterns in different ways and of substituting some actions for others. At the same time, a child observes that not only he but other people too can be agents and perform the same actions as he can (Sinclair 1973a, Sinclair-de Zwart 1974).

Sinclair (1971, -de Zwart 1974) assumes that also the earliest semantic and syntactic relations in a child's utterances show the basic action-patterns by which he relates one object to another. On the average, at the age of one year a child begins to produce meaningful speech which is related to action. Through copying, acquired components including the duration, intonation and melody of utterances appear during that time in the speech of children (Sinclair 1971).

One-word utterances are followed by two-word combinations in which the semantic component is still more prevalent than the syntactic. Most often the words combined together are in their basic uninflected form; they are combinations of noun + noun ('hattu pää', hat head), noun + verb ('pallo antaa', ball give) or verb + noun ('ajaa auto', drive car). Brown (1970) and Slobin (1970) have classified two-word utterances as pairs of relations as Possessive, Locative, Agent + Object, Agent + Action, etc. Sinclair (1973a) suggests that two-word utterances describe the state, the characteristic or the action of a person or thing; something that a child wants to be performed by the thing or something he himself is performing (e.g., 'äiti tässä', mother here; 'auto rikki', car broken; 'ovi kiinni', door closed; 'hattu pois', hat off; 'kiipee alas', climb down).

When naming a thing ('that ball') or when asking a thing to reappear ('more ball') a child shows that he can distuingish between name and action. According to McCall (1976) a clear analogy can be observed between the activities of the sensorimotor stages and the linguistic utterances. A child's verbal request for a thing to reappear corresponds to the circular reactions of the sensorimotor stage, at which the child repeatedly produces the same action in order to

create e.g., a pleasant sound he has heard.

According to Brown (1973a) a child's early experiences in handling things and the consequences of the handling are a prerequisite for later verbal utterances which distinguish between the agent, the action, and its object. The first signs of these syntactic compontents being organized appear when a child uses his name as the subject or the object of a sentence in a way suitable to the situation ('Anu piirtää', Anu draws; 'Anua kattomaan', look Anu). After the relationships between agent and object, and object and action have been established, the subject-predicate-object form becomes the prevailing sentence type according to which a child constructs his verbal utterances (Sinclair 1975). He first acquires the basic structure of the sentence before he can make his utterances more accurate by adding necessary inflections to the words.

By observing children's activities and the speech used in them, signs of understanding the first morphological forms can be seen as early as at the production stage of two words with no inflections or prepositions (Bowerman 1973, Brown 1973a, Slobin 1973). Brown (1973a), who recorded the spontaneous speech of three children for many years, noticed that the children produced utterances ('put box', 'lay floor') just when they were placing a toy in a box or on the floor. The interpretation of the utterances in their actional contexts indicated clearly that the children understood simple locative prepositions (in, on) although they did not produce these utterances in their speech. The contextual interpretation of two-word utterances made by Finnish-speaking children shows that children can understand locatives ('missä', where; 'mihin', where to) ('hattu pää', hat head; 'tutti suu', dummy mouth; 'auto talli', car garage) at a time when they cannot yet produce them (Bowerman 1973, Mikkonen 1973, Lyytinen 1975, 1976).

Brown (1973a) and Bloom (1970) noticed in the two-word utterances of children signs of understanding the possessive relationship ('mummy sock', 'Adam cycle'). Similar examples can also be found in Finnish ('täti auto', auntie car; 'äiti laukku', mummy bag). Bloom emphasizes the role of contextual clues in interpreting the meaning of utterances. The analysis of the subjects' speech indicated that the utterance 'mummy sock' had two meanings, one of which indicated a possessive

relationship and the other an imperative summons for action in which the child asked his mother to help him to put on his sock. Similar observations on the comprehensions of words specifying location and possession also appear in Gvozdev (1949) who reported the acquisition of Russian inflections in early childhood (Elkonin 1973). According to Brown (1973a) the later appearance of the correct inflections (e.g., possessive) only codes a function which the child has already understood and expressed implicitly.

Slobin (1973) has supplemented Sinclair's description with both empirical and theoretical observations. The central claim made by Slobin is that every child moulds the grammar of his native language for himself. In order to do this a child must actively observe not only the speech he has heard but also the situations and activities in which the speech appears. In addition, a child must be able to handle and organize his physical environment, to process the information, and to store it in his memory. Slobin emphasizes that one- or two-word utterances do not give a real picture of the linguistic skills that a child then has. Two-word utterances already contain the first morphological forms comprehended by a child. However, defective skills for processing linguistic information and the limits of short-term memory put restraints on the verbal production of these forms. Observations agreeing with Slobin (1973) on the connections between memory and the mastery of language have been presented by Menyuk (1969), Bever (1970) and Olson (1973).

As to the Finnish language, it has also been verified that short-term memory is a central factor in explaining the mastery of morphological forms (Ruoppila 1973a, 1973b). The forms that a child may observe can partly be determined by the extent of the memory. When the capacity of the short-term memory is small, a child can only preserve short utterances in his memory. The observation and analysis of long and complex morphological forms cause difficulties for a young child.

Children classify the speech they have heard on the basis of the morphological forms they have already acquired. Thus it is understandable that analogical reasoning has also been verified as being related

to the mastery of Finnish morphological forms among 3- to 5-year-old children. By combining knowledge about the capacity of a child's short-term memory and about the skills demanding analogical reasoning, one can predict how a child masters the inflections of his native language and how he acquires them (Ruoppila 1973a, 1973b).

Many cross-linguistic studies have shown that the acquisition of inflections follows a certain developmental order so that the acquisition of new forms is related to the acquisition of corresponding cognitions. Bloom's (1970) observations on the development of negation, Cromer's (1968) and Antinucci & Miller's (1976) results from the mastery of time concepts, Parisi & Antinucci's (1970) report on the use of words qualifying place and location, Lyytinen's (1974, 1975), Päivinen's (1972), Ruoppila's (1972) ano Ruoppila & Liste's (1967) results on the mastery of adjective comparison as well as Ferreiro & Sinclair's (1971) experiments in changing the order of two temporally successive sequences of activities showed that children expressed these forms verbally only after the cognition connected to them had been interiorized. The results point to the conclusion that the development of a cognition activates a child to look for new forms to express that cognition (Cromer 1974).

Although the mastery of cognitions is closely connected to the acquisition of linguistic forms, linguistic and cognitive development do not, however, always proceed side by side. Moreover, the linguistic complexity of an utterance can influence the order in which it is acquired (Slobin 1973, Beilin 1975). Slobin cites examples from Finnish and Arabic. Finnish-speaking children acquire yes/no questions later than children with English as their native language. In Finnish the marker -ko/kö is attached to the question word which is then moved to the beginning of the sentence. Since the intonations of a question and a statement do not differ from one another, it is more difficult for Finnish-speaking children than for others to process the information connected with question formation and to learn the rules concerning them.

In Egyptian Arabic, the complete forms of the plural are not acquired until at the age of nearly fifteen because the plural is an especially complex grammatical form in Arabic. That is why Slobin

emphasizes that when examining the connections between language and cognitions, one must also observe the situations in which cognition helps a child to understand an utterance, but in which the linguistic complexity of the utterance limits its production.

2.2. Linguistic errors and their importance in language acquisition

It has been shown that there are certain errors made by all children at the early stage of language learning such as leaving out and over-generalizing endings, replacing some endings with others, substituting objective forms for nominative ones (Ervin 1964, Cromer 1968, Campbell & Wales 1970, Lyytinen 1973, Slobin 1973, Tanz 1974, Beilin 1975, Kaper 1976, MacWhinney 1978).

Errors in the spontaneous speech of children have been observed by diarists in many countries (Stern & Stern 1907, Jespersen 1922, Smith 1933, Kahane et al. 1958). These studies have shown that young children have their own grammatical rule-system according to which they act in new situations. The inflections used by the children 'he goed', 'my foots', 'I gived' are not mere imitations of adults' language heard but examples of creative rule-governed behaviour (Ervin 1964). According to Campbell & Wales (1970), children at first produced correct forms of the English strong verbs by copying the linguistic models they had heard. After having learned to form the past tense with the ending /-ed/ the children also started to inflect the strong verbs according to the model of the familiar and regularly-inflected words.

It has been proved that incorrect combination and overgeneralization of suffixes also appear at the early developmental stage of Finnish-speaking children (Lyytinen 1973). The special characteristics of Finnish, such as noun inflection in the different cases, personal suffixes in verbs and gradation in the stem (cf. Appendix 1) make for a wider occurrence of errors than in English (Brown 1973b). Children can form the past tense (the marker -i in Finnish) in the following way: 'anti' instead of antoi, 'kaati' -kaatoi, 'leiposi' - leipoi, 'otta-

si' - otti respectively. The control of the gradation in a stem causes the children difficulties at first. It follows from this that utterances like 'käpyt' instead of kävyt, 'jalkalla' - jalalla, 'mäkin' - mäen, 'märkämpi' - märempi respectively often occur in the speech of young children. Such utterances do not appear in adult speech. These inflections indicate that a child independently moulds the language and also applies the inflections he has learned incorrectly.

In the field of language as well as in those of other cognitive skills, development gradually proceeds through wrong response to correct performance. As to language, this is supported e.g., by Cromer's (1968) observations on the use of the perfect tense and Beilin's (1975) results from the acquisition of the passive among English-speaking children. According to Beilin the passive forms are at first replaced by the active, at the next stage the forms linguistically verge on passive constructions, and at the third stage correct forms can be produced irrespective of the situation.

Slobin (1973) suggests that 'new forms first express old functions, and new functions are first expressed by old forms'. It follows from this that while children are learning new rules, they combine the inflections they have learned incorrectly and overgeneralize them. The theoretical approach, in which language acquisition is examined in connection with a child's cognitive development, does not try to ignore linguistic errors as incidental, disturbing behaviour, but considers them to be an essential part of language learning. It is further emphasized that errors provide more precise information than correct performances about a child's level of thinking and about the reasoning strategies with which he approaches a problem (Inhelder, Sinclair & Bovet 1974).

Cognitivists and learning theorists view errors in quite different ways. When trying to increase the amount of correct performances by decreasing errors, learning theorists do not take into account the developmental information contained by the erroneous responses. Some of children's errors are typical to their age. However, the occurrence of these errors in a child's speech even a year or two later may reflect the fact that a child's linguistic skills have not developed in the way typical to his age group. If a child's speech totally

lacks some forms or if they are always incorrect, the child has perhaps not yet acquired the cognitions needed for the mastery of the forms in question. As regards these incorrect responses, the influence of training on them remains small. According to Inhelder, Sinclair & Bovet (1974) permanent changes in linguistic skills can only be expected when children have acquired the cognitions on which their mastery is based.

Except for the laying-down of these general principles, the linguistic errors of children of various ages have not yet been systematically analysed nor have the connections between linguistic errors and children's cognitive level of development been examined. It is, however, important to get a clear picture of this field. As to developmental diagnostics, linguistic errors are important since they reflect, besides the mastery of linguistic skills, the connections in the prevailing level of a child's activities in remembering and reasoning. Linguistic errors tell us just as much as correct forms about the linguistic processing capacity of children and how to plan teaching material suitable to that capacity.

2.3. Adult-child interaction and the conscious guidance of a child's development as activities promoting the acquisition and mastery of language

According to Sinclair (1971, 1973b, 1975) language acquisition presupposes continuous interaction between a child and his social and physical environment. Through interaction with his environment a child learns the central components of action by generalizing and abstracting. Sinclair does not, however, make more accurate the functional characteristics of the environment which are central from the point of view of language learning. Neither does she describe the nature of mutual activities of adults and children, nor does she sufficiently emphasize the meaning of the conscious guidance of children's skills in language learning. At this point Sinclair's as well as Slobin's

views need to be made more precise. Figure 1 presents a model based on the previously presented theoretical and empirical information. The model describes language acquisition at the early stage of development and the factors connected with it.

According to Herriot (1970) it is important that when adults are taking care of a child and/or are handling things, they at the same time name the things, describe their qualitative characteristics and their way of functioning. The verbal utterances heard by a child stay in his mind through the behaviours and events with which they are temporally associated. Later under corresponding conditions the activation of these behavioural schemes is followed by the activation of verbal utterances. By their own behaviour adults can either encourage or retard the formation of linguistic schemes and influence the many-sided and flexible combination of the schemes; but the order of the schemes' appearance cannot be changed by adults.

Bruner (1977) suggests that the importance of play is central because it provides opportunities for different kind of joint activities between mother and child. A child gradually learns to interiorize the concepts agent, action, object, and recipient through playlike activities in which an adult is present. In mutual play a child can exercise combinatorial skills for dealing with the social and physical environment and thus learns not only basic forms of activity but also how to substitute some activities for others and how to change their order. Bruner assumes that the acquisition of the rules related to the mastery of language occurs by analogy with activity rules. The differentiation of these rules on the basic prelinguistic level helps a child to understand linguistic utterances describing the activities and later, when the activity situations appear, to produce meaningful speech related to them (Bruner 1975, 1977).

It is obvious that under the conscious guidance of an adult a child can acquire linguistic skills better than when the guidance is casual or does not exist at all. Adults should transmit to a child the ways in which his social and physical environments function and offer a child playthings and guide him to adequate play behaviour and in handling toys (Saporozhets & Elkonin 1971). By varying his gestures, his tone of voice, the qualities of the things to be acquainted

with and his way of presenting them, an adult can guide a child to orient towards his environment and to observe its special characteristics. Moreover, orientational activities transmitted through guidance have been proved to be of essential significance to a child's cognitive development. Generalized orientation raises the sensitivity of observations, makes the handling of information more effective and thus promotes learning in general (Lewis & Goldberg 1969, Lewis, Goldberg & Campbell 1969, Lewis 1971).

The younger the child, the more important is the adult's role as the guide and promoter of the child's development, and the more significant the social interaction between the child and the adult taking care of him (Yendovitskaya 1971). When guiding a child's activities it is, however, especially important to pay attention to the global character of child behaviour without restricting oneself to the cognitive level only. The various parts of cognitive and socio-emotional development are closely related and cannot be separated (Kamii 1972).

Through mutual activities with adults and other children, a child adopts the basic models for interactional behaviour as early as during the first year of his life (Lewis & Goldberg 1969). The way in which a child orients towards his environment is connected with how others react to his initiatives in communication, how easily they are noticed, and in what way they are responded to (Yarrow, Rubenstein, Pedersen & Jankowski 1972). In order for a child to adopt an active role in interaction, he should possess a generalized expectation that he can influence his surroundings with his behaviour. The more consistently and spontaneously an adult reacts to a child's initiatives, the stronger becomes a child's desire to orientate actively towards his environment (Lewis & Goldberg 1969). This kind of orientation towards environment is a central component in learning to learn. A child who does not feel he is influencing his environment is not interested in examining it. At the same time his desire to accommondate new information to the already acquired decreases. These differences in motivation and orientation which come about early are cumulative and can later be traced in the difference in performance between linguistic and cognitive skills of children.

According to Shugar (1976), one of the most important tasks of

The comprehension of language and production of speech presuppose a specific preverbal cognitive structure acquired by the child during the first eighteen months in actional interaction with his physical and social environment

Factors connected with the formation of preverbal cognitive structure

Neural development of the child's central nervous system

Gradual integration and differentiation of patterns for thinking and action. Extention of methods for acquiring knowledge and increase in memory capacity

Learning

Conscious guidance of the child's development. Cognitive and socio-emotional adult-child interaction

Preverbal cognitions central to language acquisition

Co-ordination & generalization of action patterns	Active observation of action connected with speech situations. Processing of information and storage in memory	Achievement of object permanence	Distinguishing between action-agent-object	Representational activities: representation of the reality with images and symbols

Basis of knowledge of physical environment, such as time, space, gravity, volume

Basis for mastering linguistic skills: rule system for sentence formation and word inflection

Basis for learning logico-mathematical concepts

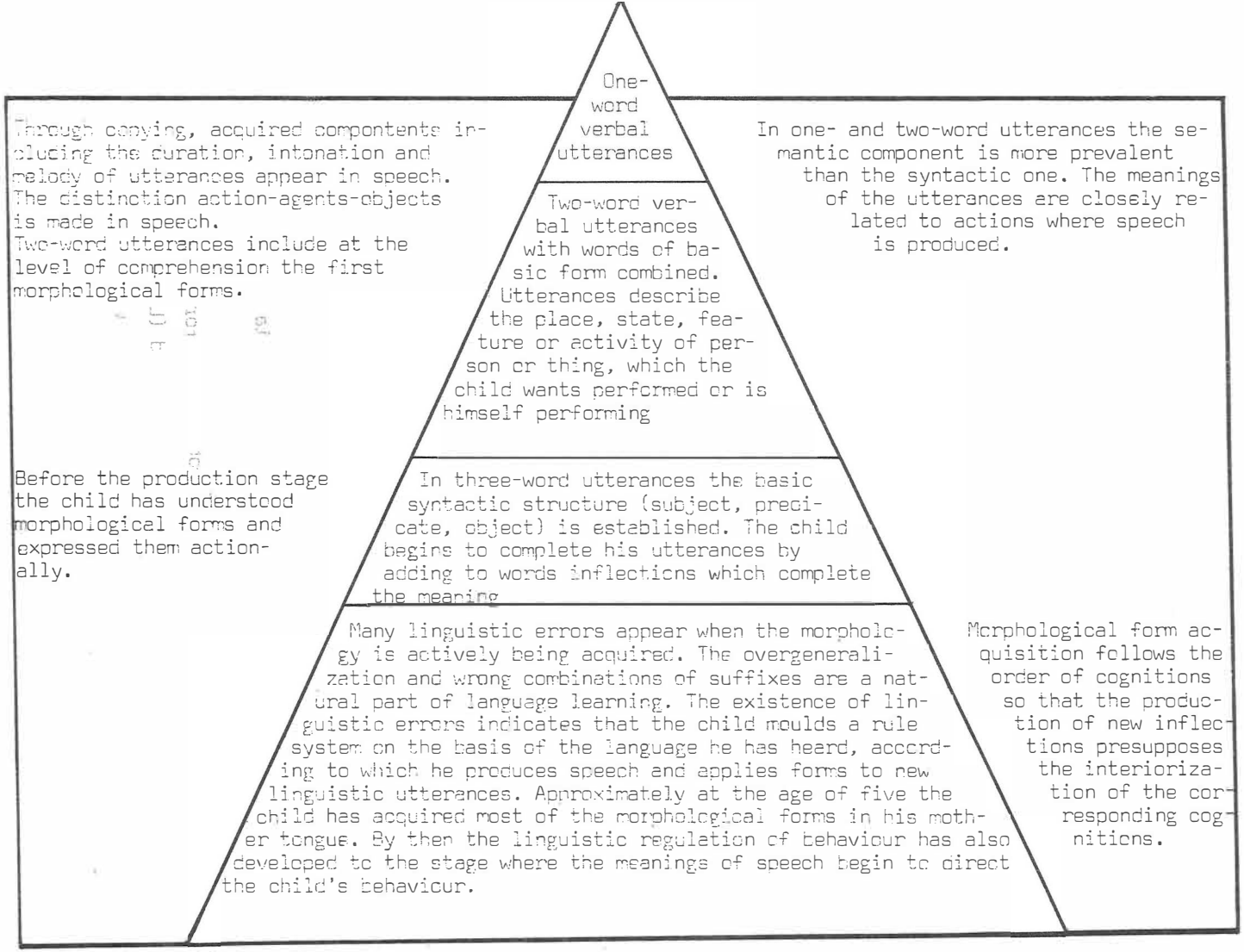


Figure 1. Stage model of language acquisition

an adult is the reception of a child's activities and responding to them. Thus an adult can transmit to a child feedback about the characteristics of his activities and about their influence on the recipient. This is the basis for active adult-child interaction, in which both influence each other.

A notable part of language learning and other cognitive skills happens in everyday adult-child interaction in which a child has the opportunity to analyse his environment and to adopt new items through play and other activities. Experiments in which adults have consciously striven for the improvement of children's linguistic skills with various training methods have provided us with positive results from comparatively little training (among others Cazden 1969, Nelson et al. 1973, Whitehurst & Novak 1973). According to Moerk (1976) the extent of the results could be further increased if the guidance were started early and if it proceeded systematically, forming a part of adult-child daily behaviour.

When training programmes are being constructed it is important to know the age and cognitive developmental level of the children to be taught. Taking the developmental level into account means that each set of tasks is analysed separately from the viewpoint of the cognitive activities as well as the level of concept formation that is demanded of the learner (Hunt 1961, Galperin 1969). This makes possible an orientation towards tasks which is a central factor in explaining learning results. These claims have been supported by Popova's study (1958) of the influences of different training programmes on the acquisition of morphological forms among Russian children from an age-group of 1 year 10 months to 3 years 6 months. The best results were achieved in a programme realized in a playlike and lucid manner compared to learning through repeated spoken trials (cf. a more accurate description in study 2, pp. 39-40.

Studies with the purpose of teaching morphological forms to children under school-age have also been carried out in Finland (Luukkonen & Ruoppila 1969, Ruoppila 1972). Both rare and artificial words, the length, ending, and gradation of which have been systematically varied, have been used in the training programmes. The programmes have differed from one another in the amount of different inflections in-

cluded in them and in the amount of times the programme has been presented to the child. The training has been run individually using colourful picture cards. Learning results stable at least for six months have thus been achieved with comparatively short training.

Great individual differences have already been observed in young children in the mastery of Finnish morphology (Luukkonen & Ruoppila 1969, Päivinen 1972, Lyytinen 1975, 1976). It is further known that linguistic skills are cumulative in nature and that they reflect on the other fields of development. Thus the early guidance of language development is one of the most important ways of overcoming learning difficulties. This is indicated among others by Pekkanen's (1971) and Kuparinen's (1975) results, according to which later at school-age the mastery of morphological forms among 8-9 -year-old children with difficulties in reading and writing was clearly lower than that of average performance in their own age-group. This indicates that a child must first master the morphology of his mother tongue in his spontaneous speech before he can produce these forms correctly in reading and writing.

3. THE STUDIES

3.1. The influence of training on the mastery of Finnish morphology in 3-, 4- and 5-year-old children

Study 1 (Päivinen 1972) was concerned with the short- and long-term influences of training on the mastery of Finnish morphology in 3-, 4- and 5-year-olds. The training was supposed to (1) increase the mastery of morphological forms so that (2) among children of different ages the clearest influences would appear in different forms. The learning results were assumed to be (3) related to the amount of training as well as to (4) the association value of the stimulus words used in teaching. Furthermore, the training was assumed to (5) become generalized from one type of test to another so that the training in the production of morphological forms would also increase their comprehension.

3.1.1. Method

Subjects

The subjects (N=72) were 3- (N=24; mean = 3 years 6 months), 4- (N=24; mean = 4 years 6 months) and 5-year-old (N=24; mean = 5 years 4 months) girls (N=40) and boys (N=32) from the kindergartens and children's clubs in the city of Jyväskylä. In each age-group the children were divided into three groups: a control group (N=8) and two experimental

groups, one of which (N=8) was trained three times and the other (N=8) five times. The subjects came from skilled working- and middle-class families.

Before the training, the intelligence level of the children was estimated by the C-series of the KTK performance scale (Elonen, Takala & Ruoppila 1961). The amount of passive vocabulary was measured by a vocabulary test (Ruoppila 1971), and the mastery of producing and comprehending morphological forms with tests constructed for this purpose. The experimental and control groups were balanced with regard to the above-mentioned variables so that the means of the groups did not differ significantly from each other (the t-test comparisons of independent groups).

Tests on morphology

Production tests. The production of morphological forms was measured before training (pretest), immediately after training (post-test I) and five months later (post-test II). Each of these three tests used 54 items to measure the mastery of nine Finnish morphological forms. The morphological forms were the same in each measurement, whereas one third of the tasks presented in the post-tests were new to the children. The purpose of changing the items was, on one hand, to examine the transfer of training and, on the other hand, to eliminate the correct responses which could have been caused by the repetition of the items. The morphological forms included in the tests and their Finnish allomorphs are presented in Table 1.

The test items were presented to the children with the help of picture cards which had been constructed for this study by applying Berko's (1958) method. The pictures were intentionally drawn colourfully and their topics chosen to interest children. The pictures were not related to any specific contents or events because their only purpose was to give meaning to the words and to motivate children to make verbal utterances.

Table 1. The morphological forms and their Finnish allomorphs in the production tests

The morphological forms		Allomorphs
Inflection of adjectives	comparative	-mpi
	superlative	-in
	plural partitive of adjective	-a, -ä, -ta, -tä
	adverbial suffix	-sti
Inflection of nouns	inessive	-ssa, -ssä
	partitive	-a, -ä, -ta, -tä
Inflection of verbs	active indicative past	-i
	active indicative present	- no special ending
	passive indicative present	-taan, -tään, -daan, -dään

(cf. Appendix 1)

All the measurements were run individually. The order of the items was randomized so that each child could pick one picture card at a time from a mixed pack of cards. This was a way to control any order effects on the responses e.g., caused by the same form appearing several times. After the child had picked a picture card, the experimenter read to the child the sentence written on it which briefly stated the event or object presented in the picture. The subject was then asked to complete the sentence. The child was judged to have mastered or not to have mastered the form on the basis of the utterances he produced as a response to the cards (e.g., Poika pistää lelun kupluun. Lelu on nyt _____ (kuplussa)./The boy puts the toy into the kuplu. The toy is now _____ (in the kuplu.). All the responses were recorded.

Comprehension tests. The comprehension of the morphology was examined in the pretest and in post-tests I and II by measurements in which the comprehension of six Finnish morphological forms was mapped by 36 items (six items per form). The morphological forms included in the tests and their Finnish allomorphs are presented in Table 2. The forms were the same both in the pre- and post-tests. One third of the tasks were new in each test.

Table 2. The morphological forms and their Finnish allomorphs in the comprehension tests

The morphological forms		Allomorphs
Inflection of adjectives	comparative	-mpi
	superlative	-in
Inflection of nouns	comitative	-ne
	abessive	-tta, -ttä
Inflection of verbs	passive indicative present	-taan, -tään, -daan, -dään
	passive indicative perfect	-tu, -ty, -ttu, -tty

(cf. Appendix 1)

The tasks were presented to the children with picture cards. Three pictures had been drawn on each card. The experimenter pointed at the first picture and read the sentence written on the card and asked the child to choose from the two alternative pictures the one in which the matter in question appeared (e.g., Katsopas tätä kuvaa, siinä tyttö kehnää nukkea. Näytä sinä, missä kuvassa nytkin kehnätään nukkea./Look at this picture, a girl _____ (kehnää) a doll. Now you show me, in which picture a doll also _____ (is being kehnätään). The place of the correct alternative on the picture cards was varied randomly.

The choice of the morphological forms and words to be inflected

A criterion for choosing the morphological forms was, on one hand, that they should form a representative sample of Finnish forms concerning the inflection of verbs, nouns and adjectives. The morphological forms should, on the other hand, be suitable, from their degree of cognitive difficulty, for the group so that the tasks would not be too difficult for 3-year-old children nor too easy for 5-year-olds. Earlier studies dealing with the mastery of Finnish morphology in 3-6-year-olds (Himberg 1967, Ruoppila & Liste 1967, Luukkonen & Ruoppila 1969, Malin & Ruoppila 1969, Ruoppila 1969, 1972) were of help in choosing the morphological forms. Archaic Finnish 2-3 syllabic words (Lönnrot 1874) were chosen as stimulus words for both the production and comprehension tests. The number of syllables in adjectives and nouns and the amount of syllables and the inflectional form (singular-plural) of verbs were varied in the stimulus words. The stimulus words were not used in the test items in their original meaning. The use of archaic words was an attempt to make sure that children could not perform the tasks merely by copying models of colloquial Finnish.

Before the tests were constructed, three separate groups of students (N = 30 + 30 + 15) estimated the association value of 140 words each. The definition of association value was made by estimating with the scale 1-10, how easy or difficult the stimulus words were to learn (Mikkonen & Strömmes 1969). Number 1 meant words difficult to learn and number 10, words easy to learn. 246 of the estimated words were thus chosen for the pre- and post-tests and for the training programme; half of the words had a high association value, half of them low. The lowest word mean of the words with high association value given by the raters was 7.21, and the highest among words with low association value was 3.92.

The training programme

The training method was a structured, individually run programme in which the children were taught to produce inflections with the help of picture cards. Bright colours and topics interesting to the children (animals and moomins) were used in the picture cards. The training programme consisted of 36 tasks; the nine morphological forms of the production test were trained with four items each. The pictures and the items in the training programme were not used in other measurements. The criteria for choosing the words to be inflected were the same as for the comprehension and production tests. The presentation of the tasks was also randomized in the same way. The difference between the training programme and the pre- and post-tests was that during the training programme the experimenter gave the correct answer emphasizing the ending if the child could not answer or if he answered incorrectly (in the pre- and post-tests the children's responses were not corrected).

During training, the child's correct performances were rewarded both verbally (thanking) and non-verbally (e.g., a nod, a smile). The experimenter tried to increase the children's motivation by rewarding the children not only for correct reactions but also for their interest towards the picture cards or the tasks in general. During the training the experimenter talked with the children informally e.g., by answering their questions or their comments about events on the picture cards.

The average duration of the training periods was 15 minutes. After the training the children were given the opportunity to draw and to look at illustrated books for a while if they wanted to. The time between the trainings was 3-4 days. Thus the training of the three-times-trained group took one and a half weeks, whereas that of the five-times-trained group took two and a half weeks.

Scoring of the tests

A completely correct answer in the production test received one correctness point. Responses in which the suffix was correct but in which the stem was incorrect (e.g., it had been clipped, lengthened or the letters or syllables reversed) received one model point. Other answers were classified as erroneous. When the experimenter was not certain he had heard the suffix correctly, the child was asked to repeat his answer.

Dialectal inflections often appearing in colloquial speech and lacking the required form were not accepted as correct answer. This procedure was decided upon since there were no other objective criteria for the mastery of each inflection than the forms defined by a grammar-book (Penttilä 1963) which were then used as the standard for correct responses. Since dialectal inflections mainly appeared in two of the morphological forms - the partitive and the past tense - the scoring did not affect the results (Päivinen 1972).

Every correct choice of a picture in the comprehension test received one point. The problems associated with the comprehension tests as used in these studies are discussed in pp. 92-93.

3.1.2. Results

The reliability of the production and comprehension tests was estimated by the split-half method. The reliability coefficients of the tests (Guilford 1954) for different age-groups are presented in Table 3.

The reliabilities of the tests were satisfactory. In the production test the coefficients varied from 0.83 to 0.93 and in the comprehension test from 0.64 to 0.87. The reliability coefficients of each morphological form, calculated from the results of the combined age-groups (N=72), were also sufficient; in the production test 0.70 on the average and in the comprehension test 0.65 respectively.

Table 3. The reliability coefficients of the production and comprehension tests in the pretest

	Production		Comprehension
Age in years	Pretest		Pretest
	Model	Correctness	
3	.97	.93	.64
4	.92	.83	.87
5	.91	.87	.73

The intercorrelations of the morphological forms

Table 4 presents the intercorrelations of model variables calculated from the pretest results of the combined age-groups. The intercorrelations of the morphological forms were 0.50 on the average, not taking into account the superlative and plural partitive of adjectives whose correlational coefficients to the other morphological forms were below the average. The low variance in the mastery of these forms could to some degree explain the low correlation coefficients. The other morphological forms with higher variances appeared to form a field of linguistic skills related to one another.

The correlation coefficients between the model and correctness variables of the morphological forms varied from 0.80 to 0.90. The high correlations were understandable since both variables were parts of the same test; in order to achieve correctness, one had to master the model.

The influence of training on the learning results was studied by a three-factor analysis of variance with repeated measures (Winer 1962). The criteria for the factors in the analyses were age, amount of training, and times of measurement. The immediate effect of training was examined by analysing the changes between the pretest and post-test I. The stability of the results was tested by examining

Table 4. The intercorrelations of the morphological forms

The morphological forms	1.	2.	3.	4.	5.	6.	7.	8.	9.
1. comparative		.30	.23	.51	.39	.54	.69	.70	.48
2. superlative			.02	.31	.19	.26	.23	.32	.34
3. plural partitive of adjective				.31	.31	.34	.32	.33	.20
4. adverbial suffix					.38	.53	.52	.58	.54
5. inessive						.42	.40	.62	.35
6. partitive							.50	.69	.44
7. active indicative past								.68	.51
8. active indicative present									.57
9. passive indicative present									

$r \geq .19$, $p < .05$

$r \geq .27$, $p < .01$

the changes between post-tests I and II. When accounting for the influence of the association value on the learning results, the analysis was based on amount of training, association value of stimulus words, and times of measurements. ANOVAs were run on each age-group separately.

Immediate and long-term effects of training

The immediate effects of training on the mastery of the model ($F=14.20$, df 2/63, $p < .001$) and of correctness ($F=13.40$, df 2/63, $p < .001$) in the production test were very significant. The learning results were stable for at least five months. The main effect of training from post-test I to post-test II was significant both in the model

variable ($F=16.17$, df 2/63, $p < .001$) and in the correctness variable ($F=10.25$, df 2/63, $p < .001$). The interaction of training and post-tests I and II was, on the contrary, not significant in either of the variables (model $F=2.93$, df 2/63, ns. and correctness $F=1.73$, df 2/63, ns.).

The comparison of the means between the age-groups showed that training increased significantly the mastery of the model and correctness of the morphological forms in 3- and 4-year-old children and the mastery of correctness among 5-year-olds. Due to training, the experimental groups performed the tasks better than the control groups, and the performance order of the experimental groups also corresponded to the amount of training they had received in post-test II (cf. Figures 2 and 3). The only exception was the opposite order of the experimental groups of 5-year-olds trained three and five times in the correctness variable. This was only true in post-test I while the performance was in accord with the amount of training five months later in this group, too.

Besides training, the age of the subjects was a very important factor in explaining the mastery of model ($F=8.31$, df 2/63, $p < .001$) and correctness ($F=10.76$, df 2/63, $p < .001$) in post-test I. The training explained, however, the immediate as well as the stable effects ($F=16.17$, df 2/63, $p < .001$) at least as well as age ($F=13.82$, df 2/63, $p < .001$). In the correctness variable age was associated with a greater F ($F=18.04$, df 2/63, $p < .001$) than training ($F=10.25$, df 2/63, $p < .001$) in the post-tests.

The effects of training at various age-levels

A comparison of the age-groups revealed that the immediate influence of training on the mastery of model was strongest in 3-year-old children ($F=41.59$, df 2/42, $p < .001$) and that its effect on the mastery of correctness was strongest in 4-year-olds ($F=12.96$, df 2/42, $p < .001$). The 'top-limit' of the production test - the maximum scores

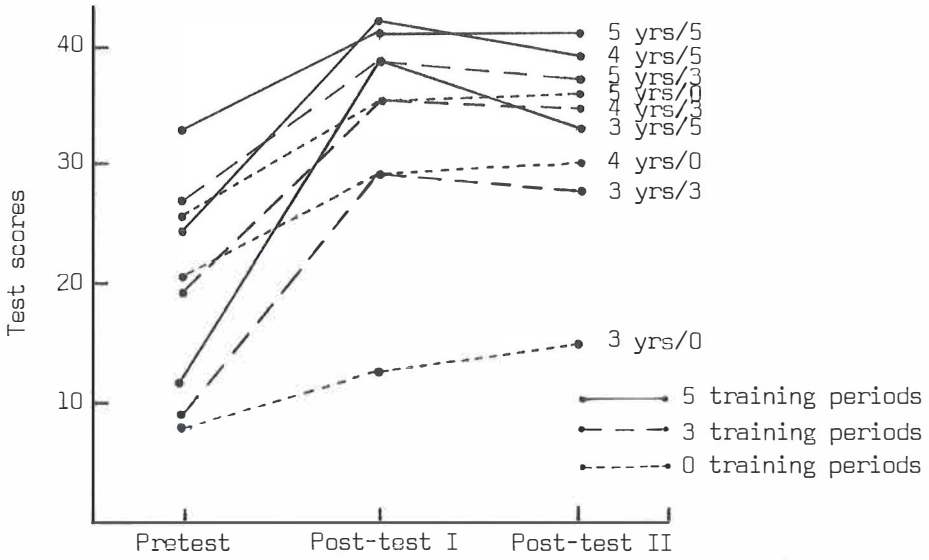


Figure 2. Mastering the model of morphological forms in different measurements among 3-, 4- and 5-year-old children

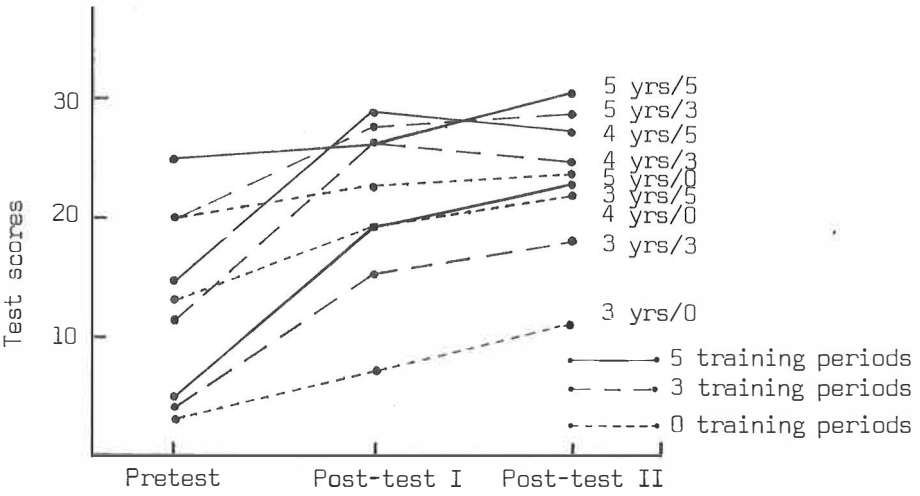


Figure 3. Mastering the correctness of morphological forms in different measurements among 3-, 4- and 5-year-old children

achieved in the mastery of the inessive, the comparative and the adverbial suffix - prevented the influence of training from appearing in older subjects as clearly as in 3-year-olds. The specific influences of training appeared at various age-levels so that 3-year-olds above all learned inessive forms, the active indicative present, and comparative forms. In 4- and 5-year-olds the clearest influence of training was found in the superlative, the passive indicative present, and in the adverb.

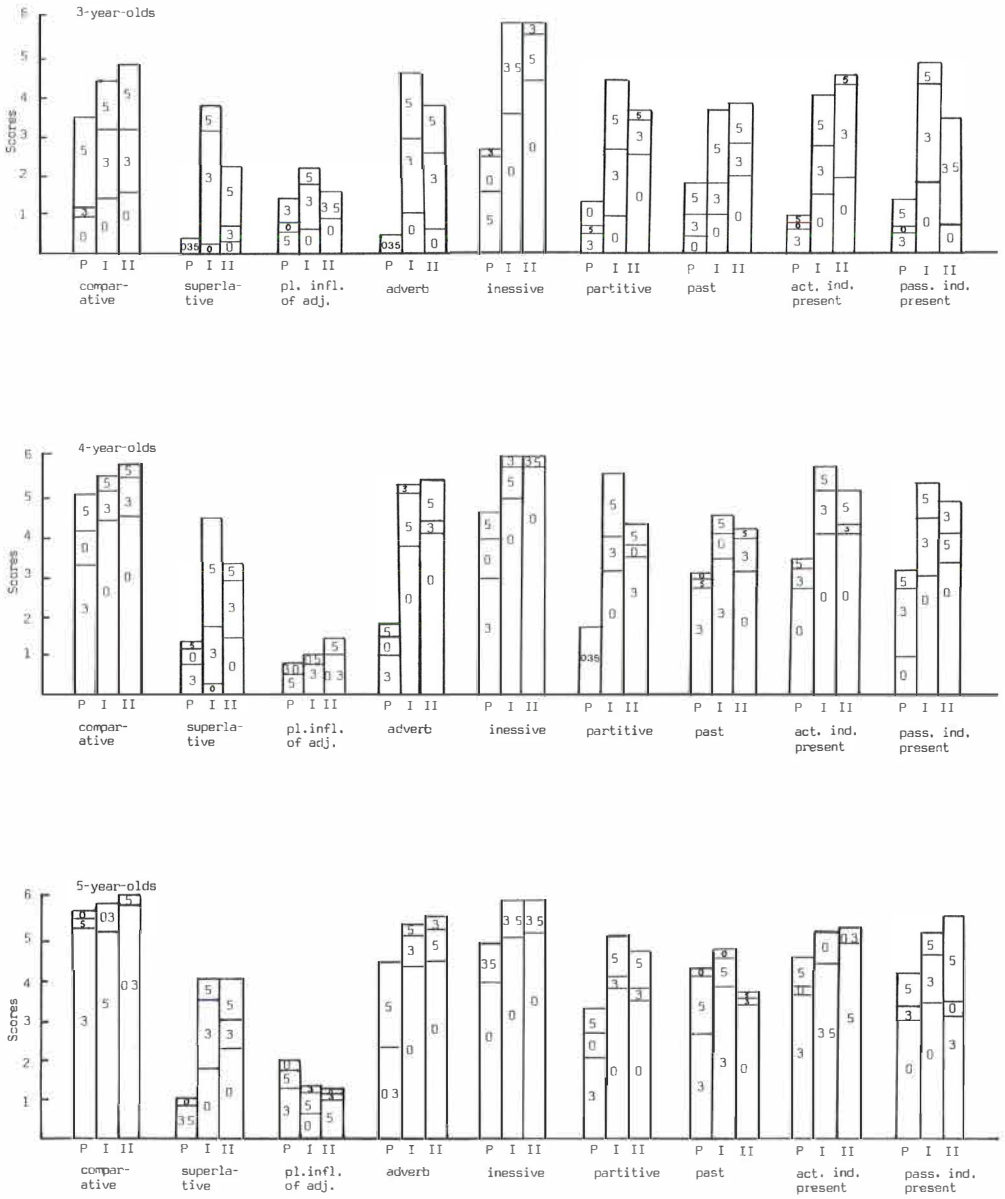
The amount of training needed was associated with the age of the subjects. 3-year-olds, and in the mastery of most morphological forms 4-year-olds too, needed to be trained five times to learn the morphological forms, whereas 5-year-olds achieved similar results after three trainings. Exception to this was the inessive, which only required three trainings in order to be learned even by 3-year olds, and the suffixes for the adverb and the comparative, in which 4-year-olds received almost maximum scores after three trainings.

The examination of the learning results in each age-group indicated that the five-times-trained group of 3-year-olds reached the pre-test level of 5-year-olds permanently. The three times trained group also improved its performance significantly but did not quite achieve the same results. It was further found that the five times trained group of 4-year-olds reached the post-test results of the three-times-trained group of 5-year-olds.

The order in which the morphological forms were mastered remained almost the same for all age-groups from one measurement to another (Figures 4 and 5). The changes in order were minor in 4- and 5-year-olds. The changes among 3-year-olds were mainly caused by the low pretest level of this age-group in the production test.

The influence of the association value on the learning results

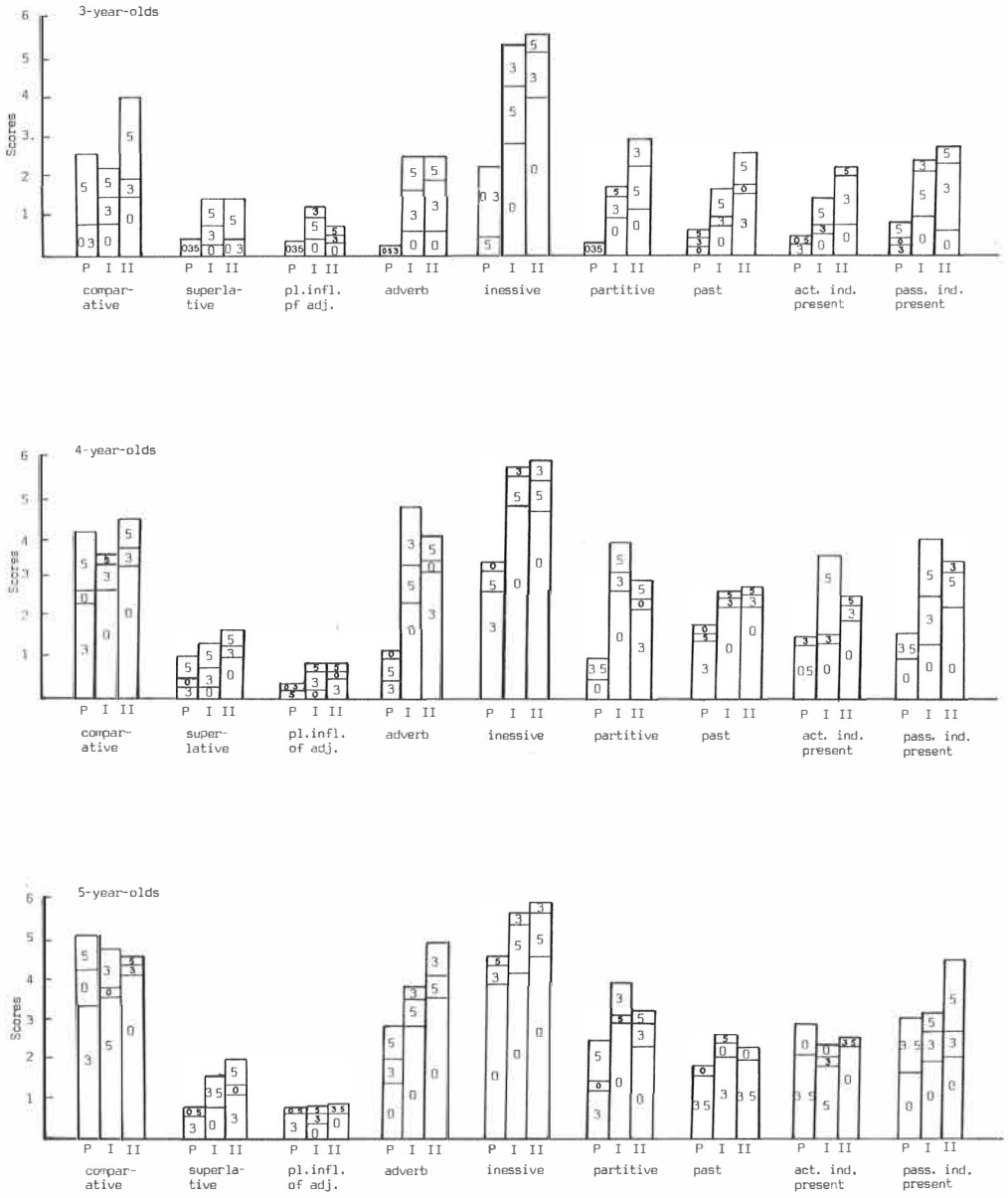
In no age-group did the association value of the stimulus words explain the variance of learning in the model variable but it was a very



P = pretest
I = post-test I
II = post-test II

5 = five training periods
3 = three training periods
0 = control group

Figure 4. Mastering the model of morphological forms in 3-5-year-olds



P = pretest
I = post-test I
II = post-test II

5 = five training periods
3 = three training periods
0 = control group

Figure 5. Mastering the correctness of morphological forms in 3-5-year-olds

significant factor in explaining the mastery of correctness. All age-groups produced significantly more correct forms of words whose association value had been estimated as high (3-year-olds $F=12.58$, df 1/42, $p < .001$; 4-year-olds $F=18.22$, df 1/42, $p < .001$; 5-year-olds $F=25.66$, df 1/42, $p < .001$). F-ratios were greatest in the oldest age-groups.

The transfer of the training

When analysing the mastery of old and new items in the post-tests it was clearly verified that the influence of training was not only specially directed towards certain words but also to new stems and endings attached to them. Old and new stimulus words were inflected by 3-, 4- and 5-year-old children equally well in both post-tests. The percentages in the mastery of old and new words were the same in the model and correctness variable.

Transfer from one type of test to another (from production to comprehension) could not, however, be explained completely. The training of the skills in production was observed to have transfer to the mastery of comprehension only among 3-year-olds. In the older age-groups - who received maximum scores in the comprehension of the passive present, the perfect tense, the comitative and the abessive - the top-limit of the tests did not allow conclusion on transfer from one type of test to another.

3.1.3. Discussion

The results supported earlier findings of learning experiments that the level of mastering Finnish morphology can be increased by training (Luukkonen & Ruoppila 1969, Ruoppila 1972). The learning results were

proved stable for at least five months. In all age-groups the order of experimental groups corresponded to the amount of training still given in post-test II. The group of 3-year-olds benefited most from the individually-run training. All 4- and 5-year-olds improved their performance but in them the upper limit of training influence could not be estimated as reliably as in 3-year-olds because of the top-limits in the tests.

In the production and comprehension tests the mastery of each morphological form was measured by six items. This was partly caused by the fact that the variances in the performances of 4- and 5-year-olds in the comprehension test remained minor in some of the morphological forms. An increase in the amount of items could perhaps have made it more difficult for the children to reach the maximum score in the test. It is likely, however, that the oldest subjects had mastered the comparative and the inessive to the extent that increasing the amount of items and making them more difficult would not in these forms have caused any changes in the achieved results.

The influence of training was strongest for different morphological forms at different ages. In general younger subjects needed more training than older subjects to acquire the same items. It was found that 3-year-olds learned the inessive and comparative forms to a degree almost reaching the post-test level of older groups. According to Brown (1973a) children, as early as at the production stage of two-word utterances in their basic form, appear to understand simple words qualifying location. 2-3-year-olds can through pair comparison estimate the qualities of things, such as size, form, etc. (Flavell 1963, Elkind 1964, Lyytinen 1975). It is obvious that the mastery of these cognitions had a bearing on the fact that 3-year-olds benefited most from the training of the inessive and comparative forms. It is also noteworthy that in the inessive, 3-year-olds achieved maximum scores even after only three training sessions.

It has been proved that the meaningfulness of words in verbal learning experiments influences the speed with which both adults and children learn the stimulus material and how they remember it (Gaeth & Cooper 1967). In this study the association value of the stimulus words had no bearing on the learning of the model for morphological

forms, but had some, however, on the correct production of the inflections. The Fs related to the association value and the correct mastery of the morphological forms became higher with age. This indicates that the oldest subjects had on the basis of what they had learned earlier, more conditional associations to words with high association values than 3- and 4-year-olds. The associations facilitate the handling of words, their recollection, and consequent inflection in a grammatically correct form.

The results also indicate that the influence of training was not specially attached to certain words, but within the same type of test transfer to totally new stems and their endings appeared in all age-groups. On the basis of this data it was, on the other hand, not possible to conclude reliably to what extent transfer occurred from production to comprehension test. This aspect requires further study.

The learning results of the comparative forms were already clear in 3-year-old children, whereas the learning of the superlative model was not stable until it occurred in 4- and 5-year-olds. The result might be explained by the fact that the youngest age-groups had not yet mastered the transitive operations of thinking, which are presupposed of the child by the simultaneous comparison of several objects (Piaget 1950, Flavell 1963, Elkind 1964).

Inhelder & Sinclair (1969) and Inhelder, Sinclair & Bovet (1974) place certain conditions on training methods and the objects of teaching. Training programmes should - from the point of view of their realization - correspond to the situations in which learning normally takes place. Further, the closer the things to be taught are timed to the recently acquired cognitions, the better are the chances of children interiorizing the items and applying them in new situations.

3.2. Comparison of the training programmes used in teaching morphological forms

Study 2 (Lyytinen 1974) examined the short- and long-term influences of training programmes differing in their orientative aspects on the mastery of morphology in 4-year-old children. The learning results were assumed to be the better the more the training programme contained factors orientating child behaviour and maintaining the orientation. Various control groups were used to answer questions left open in previous learning experiments as to what extent the achieved level of mastery of morphology was a result of (1) merely getting acquainted with the training material without controlled training, (2) the effect of the set acquired during repeated measurements and, (3) the developmental changes in the children's linguistic skills between the measurements.

3.2.1. Method

Subjects

The subjects (N=48) were 4-year-old children (mean = 4 years 5 months) from the kindergartens and children's clubs in the city of Jyväskylä. There were both girls (N=24) and boys (N=24). The children were from families representing the skilled working- and middle-classes.

Design

The children were divided into three experimental groups and three control groups with eight subjects in each. Before the actual experiment the intelligence level of the children was estimated by the

C-series of the KTK performance scale (Elonen, Takala & Ruoppila 1961), the amount of passive vocabulary by a vocabulary test (Ruoppila 1971) and the production of morphological forms by a morphology test (Päivinen 1972). After this the experimental and control groups were balanced with regard to the above-mentioned variables so that the means of the groups did not differ significantly from each other. Table 5 describes the groups in the study.

Table 5. The groups in the study

Groups	Treatment
Experimental group T	Training with toys
Experimental group P	Training with picture cards
Experimental group T & P	Training with toys and picture cards
Control group 1	Participated in pre- and post-tests and in training sessions
Control group 2	Participated in pre- and post-tests
Control group 3	Participated in post-test II

Experimental group T had toys as its training material, experimental group P picture cards and experimental group T & P both toys and picture cards. The data on group P was taken from previously collected material (Päivinen 1972). The experimental groups were trained four times. Group P was an exception because it had been trained five times. This group was included, however, because there did not seem to be any further changes in the results from five rather than four training-periods.

The training programmes contained 36 items (four items per form). The morphological forms to be taught were the same in all programmes. The stimulus words for the tasks were different in programmes T and P. The average duration of each training period was 15-20 minutes, after which the children were given an opportunity to play freely for a while, if they felt like it. The training programmes were carried out during two weeks so that the interval between the training periods was

2-3 days.

Control group 1 participated - like the experimental groups - in the pre- and post-tests as well as in the training. Instead of controlled training, the experimenter talked with the children informally while the children played with the training materials used with the experimental groups. Control group 2 participated in the pre- and post-tests. Control group 3 participated only in post-test II.

Production tests

The production of morphological forms was measured before the training (pretest), immediately after the training (post-test I) and five months later (post-test II). The pre- and post-tests and training programmes were the same as in study 1. The information about the tests, such as the choice of the morphological forms and the stimulus words; scoring of the tests and their reliability, have been presented in connection with study 1 on pp. 21-27.

Training programmes

The basis for the planning of toy programme I were Popova's (1958) results, according to which orientation towards tasks is an essential factor influencing the learning of morphology in children within the age-range 1 year 10 months to 3 years 6 months. Popova taught the children to form sentences with masculine and feminine nouns and verbs so that the ending of the verb agreed with the gender of the noun. The forms were learned best by the group to which the tasks were presented in a playlike manner. These children were allowed to carry to a playhouse animals with a masculine or a feminine name. If the child could inflect the noun and the verb in the correct form, the doors of

the playhouse opened and the animal was let in. If the child, on the other hand, gave a wrong inflection, the doors remained closed and the experimenter mentioned the error to the child. The error was then corrected together and a new task was introduced.

The learning results of a group in which the children had to repeat a picture story told by the experimenter so many times that they finally mastered the gender-agreement were notably poorer than those of the above mentioned group. Some of the children (13 from 20) learned the forms, but, in order to achieve this, the experimenter and the subject himself had to repeat the word combinations 200-300 times. The results clearly indicated that a training programme carried out in a playlike manner and by a demonstration which promotes orientation towards things to be learned brings better results than the continuous repetition of the rules in discussions with the child.

In the present study, the material of the toy programme consisted of three separate items: a house to be built, a zoo, and a garage. During the first period all children performed the task in the above order. During subsequent trainings the experimenter asked the child before the training was started in which order he wanted to play the games. It was assumed that the interest aroused by the tasks would remain higher if the child himself was allowed to choose the order of presenting the things to be learned. The experimenter participated in the games only when the carrying out of some task required it.

The toys used as training material had been chosen to vary in character, e.g., colour, form, and size. The mastery of the morphological forms - e.g., that of the comparative and superlative - was trained during the games so that the experimenter picked one toy at a time and focused the child's attention on it by saying 'Katsopas tämän talon seiniä. Tämä seinä on näin raitikas, mutta tuo on vielä _____ (raitikkaampi) ja tämä seinä on kaikista _____ (raitikkain). (Look at the walls of this house. This wall is this much 'raitikas' but that one is even _____ (more 'raitikas') and this one is _____ (the most 'raitikas') of all. After the child had inflected the stimulus word correctly, he was allowed to place the toy in the toy house anywhere he wanted. Similarly, other toys were used to train the inflection of adverbial suffixes, case endings and tenses.

The following factors were thought to cause orientation towards the tasks in programme T and to maintain the orientation from one training to another: The tasks were presented to the children by demonstration and the toys used were simple, new to the children, but familiar in topic (e.g., plastic animal or fairy figures, blocks of various forms and sizes painted in different colours and used as tables, chairs, and walls in the games etc.). The presence of the toys as such influences learning motivation positively. The training took place through auditory and visual channels. After the children had answered the experimenter's questions correctly, they were allowed to handle the toy and to place it where they wanted. If the child's response was incorrect, the error was corrected together and only after that was the child allowed to place the thing somewhere. The correct performances of the children were also rewarded verbally (thanking) and non-verbally (a nod, a smile).

Programme P was the same as in study 1 (cf. p. 25). An attempt to create orientation towards the tasks was made by drawing the pictures colourful and making their topics interesting to children (e.g., moomins, animals). The training took place through two channels - the auditory and the visual. The children's performances were rewarded both verbally and non-verbally. An attempt to maintain the children's interest in the tasks was made by the experimenter who rewarded the children's comments on the picture cards and willingly answered all questions. The tasks were presented in the form of a mixed pack during each training period so that the child himself could pick one card at a time in the order he wanted. This was thought to influence the maintenance of orientational behaviour and to direct the child's attention to the matter to be taught at that time.

The methods described above were combined in programme T & P. The two different training programmes were aimed at motivating the children in the items to be taught better than the repetition of the same programme four times. During the two first training periods, the morphological forms were taught by the toys in programme T, and during the last two, by picture cards according to programme P. The reinforcement of the correct answers was the same as in programmes T and P. It followed from the combination of the programmes that two kinds of stimulus

words and several channels - the auditory, the visual, and the tactile - were used to teach the morphological forms. The above mentioned factors were assumed to direct the children's attention to the tasks and to maintain the learning motivation better than other methods.

In all the training programmes the stimulus words were ones which do not occur in present-day Finnish and consequently, as such, were considered to have orientative influence. This study did not include an easily habituating non-orientative programme because earlier research results (Popova 1958) clearly proved that such training is not effective.

The immediate and long-term influences of training were tested by a two-factor analysis of variance with repeated measures on the latter factor (Winer 1962). The groups and the measurements were the basis for classification. The model and correctness variables were analysed separately. Analyses of the pre-test and post-test I examined the immediate influence of training while the stability of the results was tested by analysing the changes between post-test I and II.

3.2.2. Results

Immediate and long-term influence of training

The results of each experimental and control group were compared when examining the changes between the measurements. The results proved that training had increased the mastery of the morphological forms so that immediate results of learning were very significant in all experimental groups and in experimental groups P and T & P they were stable at least for five months. The control groups also improved their results from one measurement to another. The changes in the performances of the control groups were, however, minor compared to those caused by systematic training (cf. Figures 6 and 7). Tables 6 and 7 present the results of the analysis of variance in summarized

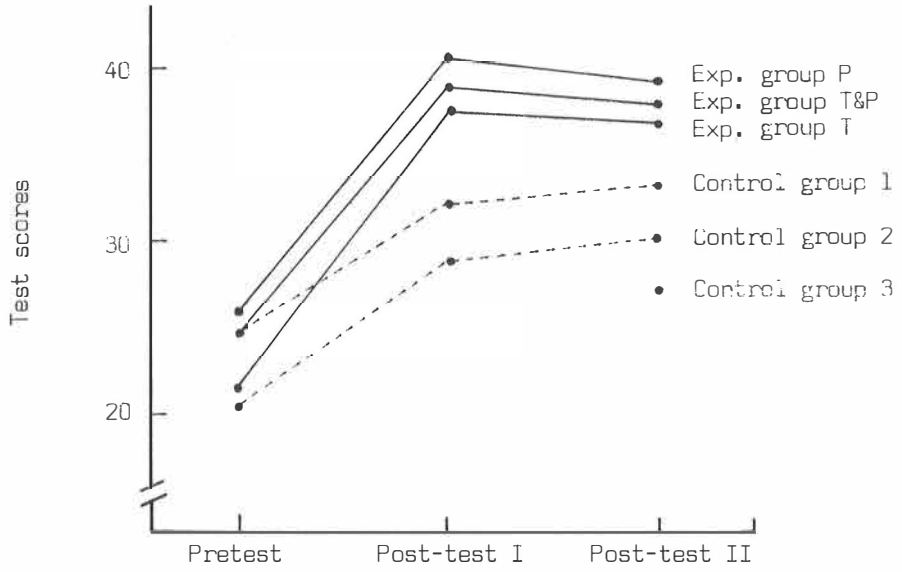


Figure 6. Learning results in the mastery of the model of morphological forms

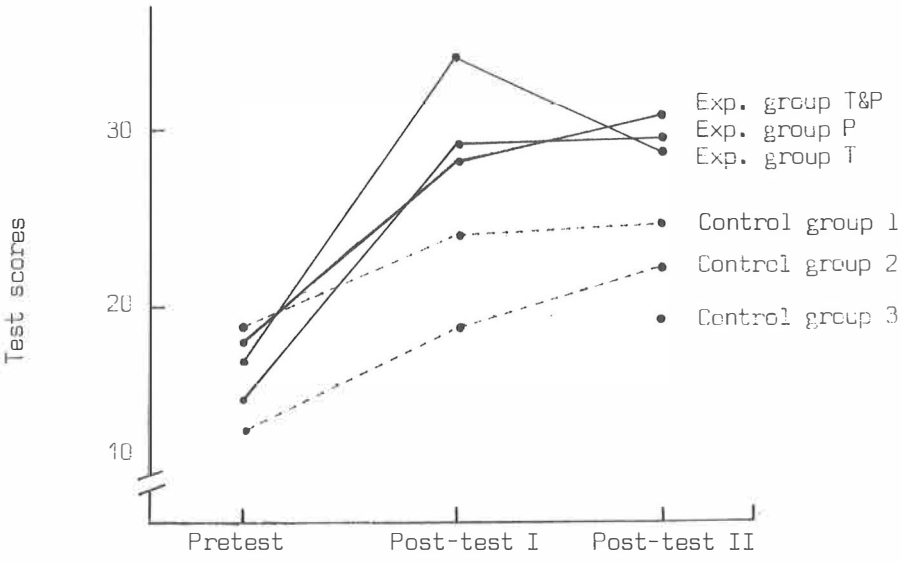


Figure 7. Learning results in the mastery of the correctness of morphological forms.

form. Table 6 shows that all experimental groups improved their performance from pre-test to post-test I significantly more than the control groups on the model and correctness variables of the morphology test (significant interaction). Table 7, which describes the stability of the learning shows that the difference between control group 1 and the group trained with toys only decreased significantly between post-tests. The weakening of the performances in experimental group T was primarily asscciated with the fact that the inflection of adverbial suffixes could not permanently be taught to this group (cf. p. 47). In the estimation of the results of learning as a whole, it can be observed that the post-test II results of experimental group T were higher than those of the pre-test and clearly better than the results of the control groups.

Results in the experimental groups

A comparison of the learning results of the experimental groups indicated that there existed no statistically significant differences either in the mastery of the model immediately after the training or in post-test II performed five months later (the results of the variance analyses are presented in a summarized form in Table 8). The differences in the mastery of correctness were also small (Table 9). The learning results achieved immediately after the training in experimental groups P and T & P remained the same for five months. The learning results of experimental group T, which performed better than the other experimental groups in post-test I, were not as stable as those mentioned above. The scores for correctness in this group decreased by 5 points on the average between post-tests I and II while remaining clearly higher than in the pre-test.

Table 6. Changes in the performances of experimental and control groups from pretest to post-test I

	Experimental group T				Experimental group P				Experimental group T & P			
	Model		Correctness		Model		Correctness		Model		Correctness	
	F	p	F	p	F	p	F	p	F	p	F	p
Control group 1												
B (Change)	96.11	.001	84.39	.001	93.13	.001	93.11	.001	83.45	.001	113.18	.001
A x B (Groups x change)	11.54	.01	12.42	.01	11.60	.01	11.65	.01	6.66	.05	6.38	.05
Control group 2												
B (Change)	66.95	.001	50.44	.001	65.98	.001	51.68	.001	57.58	.001	48.72	.001
A x B (Groups x change)	6.08	.05	10.68	.01	6.26	.05	9.65	.01	3.20	.10	5.09	.05

df 1/14

Table 7. Changes in the performances of experimental and control groups between post-test I-II

	Experimental grcup T				Experimental group P				Experimental group T & P			
	Model		Correctness		Model		Correctness		Model		Correctness	
	F	p	F	p	F	p	F	p	F	p	F	p
Control group 1												
B (Change)	0.19	ns.	4.34	ns.	0.14	ns.	0.00	ns.	0.01	ns.	0.15	ns.
A x B (Groups x change)	10.16	.01	7.28	.05	3.08	ns.	0.24	ns.	2.70	ns.	0.00	ns.
Control group 2												
B (Change)	0.48	ns.	0.32	ns.	0.39	ns.	1.10	ns.	0.04	ns.	1.71	ns.
A x B (Groups x change)	3.80	.10	9.80	.01	2.76	ns.	2.32	ns.	1.28	ns.	0.94	ns.

df 1/14

Table 8. Differences between experimental groups in the mastery of the model of morphological forms

Groups		Change from pretest to post-test I		Change from post-test I to post-test II	
		F	p	F	p
T - P	A (Groups)	0.77	ns.	1.22	ns.
	B (Change)	141.73	.001	4.15	.10
	A x B	0.01	ns.	0.00	ns.
T - T & P	A (Groups)	0.08	ns.	0.02	ns.
	B (Change)	132.05	.001	3.86	.10
	A x B	0.66	ns.	0.15	ns.
P - T & P	A (Groups)	0.27	ns.	0.73	ns.
	B (Change)	128.29	.001	2.98	ns.
	A x B	0.78	ns.	0.15	ns.

df 1/14

Table 9. Differences between experimental groups in the mastery of the correctness of morphological forms

Groups		Change from pretest to post-test I		Change from post-test I to post-test II	
		F	p	F	p
T - P	A (Groups)	1.10	ns.	0.28	ns.
	B (Change)	137.86	.001	6.21	.05
	A x B	0.17	ns.	3.71	.10
T - T & P	A (Groups)	0.19	ns.	0.11	ns.
	B (Change)	158.24	.001	2.83	ns.
	A x B	4.10	.10	4.27	.10
P - T & P	A (Groups)	0.10	ns.	0.00	ns.
	B (Change)	190.37	.001	0.00	ns.
	A x B	3.07	ns.	0.14	ns.

df 1/14

The influence of training programmes on the mastery of spesific forms

It was found that the influence of training programmes were spesific in the mastery of two morphological forms - the adverbial suffix and the passive indicative present. The results of experimental group T on the model and correctness of adverb measures were not as equally stable as the corresponding results in experimental groups P and T & P (the interaction of the change between post-tests I and II and the training programmes T and T & P, $p < .05$). On the correctness of adverb measures, the differences between the experimental groups were even greater; whereas experimental groups P and T & P improved their performances between the post-tests, the results of experimental group T decreased, but were still higher in post-test II than in the pretest (the interactions of the change between post-test I and II and the training programmes T - P and T - T & P were significant $F=12.70$, df 1/14, $p < .01$ and $F=9.00$, df 1/14, $p < .01$ respectively).

This result could partly be explained by the fact that adverbial suffixes were taught to experimental group T in such a way that an adverb of manner was demonstrated by some stable characteristic of a toy (e.g., a plastic fairy figure, which held the forefinger of his right hand up; the task was the following: 'Tuo Aku on aika liippa, se heristää sormeaankin niin _____ (liipasti)'. That Donald Duck is quite _____ ('liippa'), he is shaking his finger so _____ ('liipasti'). The activity connected with formation of the adverbial suffix did not appear in the task. But in picture card training the adverb was taught with the help of two pictures so that in the first picture the adjective was described in its basic form and in the second picture the activity connected with the adverbial suffix was visualized.

Differences between the experimental groups were also observed in the results from the use of the passive indicative present. All groups had improved their performances in post-test I. The stability was both in the model and in correctness variable connected with the teaching method. In programme T the passive forms were trained through activities; the experimenter said to the child: 'Katsopas, minä huis-

kin näin kädellä. Näytäpäs sinä, miten sinä huiskit kädellä. Näin käsillä _____ (huiskitaan)'; Look, I'm waving my hand. Now you show me, how you wave your hand. This the way we wave our hands. This actional procedure combined with picture card training produced the best results of learning in experimental group T & P, which improved its performance between the post-tests in the correctness variable.

The plural partitive of adjectives was the only morphological form in which the learning results were minor in all experimental groups. Plural partitives of adjectives were, however, found in the spontaneous speech of two-year-old children ('nää on pieniä palloja', 'hyviä mansikoita tässä'; these are small balls, good strawberries here). It is obvious that the learning results of this morphological form have been influenced by the weaknesses in the presentation of the tasks. The plural partitive of adjectives was in all programmes trained in connection with the plural partitive of the noun ('Tämä on lepsu suikula. Tuossa on monta _____ _____ ('lepsua suikulaa'). It is obvious that some of the children understood the utterance as a proper noun (This is Lepsu Suikula) and therefore left the qualifier in front of the proper noun uninflected. Similar results were achieved in study 1, in which it was found that even 5-year-old children did not always understand the tasks connected with the mastery of the plural partitive of adjectives in the expected way.

3.2.3. Discussion

The results indicated consistently with previous data (Luukkonen & Ruoppila 1969, Päivinen 1972, Ruoppila 1972) that a relatively small amount of individual training has a significant influence - stable at least for five months - on the mastery of Finnish morphological forms.

It was verified that on the average all the training programmes increased the mastery of the morphological forms equally on the average. This implies that, when linguistic skills are being taught, the results

are not significantly influenced by the training procedure used, if the programmes fulfil certain basic requirements on the dimension-encouraging orientation and if the objects of teaching are normal preschool-aged children.

Differences in the learning results between the experimental groups were found only in the mastery of the adverb and the passive indicative present. The differences in these forms may be influenced by the fact that the demonstration of the activity connected with the inflection of adverbial suffix succeeded better in the picture card programme than in the toy programme and with passive better in the toy programme than in picture card programme. When comparing the training methods which promote comprehension of passive sentences Brown (1976) also found spesific training effects. His results showed that verbal modelling in conjunction with concrete referents promoted the comprehension on the passive more than verbal modelling with pictorial referents and verbal modelling alone. According to Brown this happened because actions connected with passive sentences cannot be completely represented in pictures.

Control groups were used to examine to what extent the child's contact with the experimenter during the training periods, getting acquainted with the training material and with the pre- and post-tests, and the developmental changes in linguistic skills between the measurements, influenced the results of learning. The results indicated that the control groups improved their performance from one measurement to another without achieving, however, the post-test II level of the experimental groups in the mastery of the morphological forms. Thus the changes caused by getting acquainted with the test and the training material, and by the influences of developmental changes in linguistic skills, on the results of learninge were - though existing - minor compared to the changes caused by the systematically carried out training. This can be seen from the significant interactions of experimental/control groups and of the pretest and post-test I.

An important result was that the group trained with toys was capable of applying the forms they had learned to the picture cards. This indicated that the training did not only teach the children to react in the way required by the situation, but to apply the items they had

learned to totally new material in a new situation. According to Galperin (1969) this is the central criterion for the mastery of skills. If it had only been a question of 'test-set' learning, experimental group P should have performed significantly better than the other groups, because this group had been measured and trained with similar material.

Observations during the training periods proved that the children best maintained their interest in the items to be taught in programme T. This was influenced by the playlike method of teaching and the fact that during the training the children had an opportunity for spotaneous but task-relevant activity. When the children were handling and placing the toys the way they themselves wanted to, they were all the time inventing new combinations and thus the tasks maintained their stimulus value from one training period to another.

Teaching linguistic as well as other cognitive skills with the help of toys can be recommended, since learning then takes place in an activity situation, which is almost always a positive experience to a child. Training through activity obviously influences learning more essentially the younger the age-group is, because the attention span is less among infants than among children of pre-school age. The guidance of linguistic skills through play thus forms a good basis for the use of other methods in the future.

3.3. On the errors of Finnish inflection in 3-5-year-old children

Study 3 (Lyytinen 1973) was concerned with the errors made by 3 to 5-year-old children in the use of Finnish inflections. An attempt was made to get more detailed (Päivinen 1972) data concerning the acquisition of Finnish morphology by analysing (1) erroneous responses and (2) the changes in them as a function of training and age, as well as (3) correlations between linguistic errors and some variables describing the children's cognitive level of development.

3.3.1. Method

Design

The linguistic errors in the test data (pre- and post-tests I - II) of study 1 (N=72; 24 Ss per age-group) were analysed as a function of training and age. The words in the tests were archaic Finnish words. Thus the children's responses primarily indicated how they could apply the morphological forms they had learned to new, unknown words.

The classification of the children's responses

The classification-system of the children's responses was constructed for this study. In the classification of errors it is possible to proceed from e.g., the phenomenal analysis or errors, from the etiology of words or by examining the comprehensibility of the speech. In this study, a solution similar to the first alternative was chosen, because no earlier information was available. The responses were first classified into five main categories: I Correct responses, II Inadequate responses, III Suffix errors, IV Stem errors and V Both suffix and stem errors. Changes in category I have been examined in the first study, and this study will concentrate on a more detailed description and analysis of categories II - V.

Specification of error categories and consequent subcategories

(1) Inadequate responses (II) included utterances like: 'en tiedä' (I don't know), 'en osaa' (I can't), 'niin on (so it is), 'tämmöinenkin on' (there is one like this), 'on valmista' (it is ready), 'tuollakin on' (there is one), 'on mukavaa' (it is nice, this is nice). Typical of these errors was that the children did in no way repeat in their responses the stimulus word wanted.

The following subcategories were used in category III which was concerned with the mastery of suffixes:

(2) Partly correct suffix; letter changed or missing ('pääsötti' instead of 'pääsösti' / 'hotelost' instead of 'hotelosti' / 'urtompa' instead of 'urtompi').

(3) Suffix of another morphological form (e.g., the superlative marker has been replaced by the comparative '-mpi' and the word 'kaikista' (of all) strengthening the superlative has been added in front of it: 'kaikista tuitumpi' instead of 'kaikista tuituin' / 'kaikista atiompi' instead of 'kaikista atioin'. Other errors belonging to this category were 'suipukkaan' instead of 'suipukassa' / 'hepsalle' instead of 'hepsasti' / 'on vievottu' instead of 'vievotaan' / 'kupsivat' instead of 'kupsitaan').

(4) Stimulus word repeated without suffix (e.g., 'maiskiminen on mukavaa' instead of 'maiskivat' / 'osaa atvata' instead of 'atvasi' / 'niin hepsa' instead of 'hepsasti' / 'vielä tuittu' instead of 'tuitumpi' / 'kaikista urtto' instead of 'urtoin').

(5) Error in personal suffix: the verb conjugated in wrong person (e.g., 'leiskaa' instead of 'leiskaavat' / 'pirski' instead of 'pirskivät' / 'nopsui' instead of 'nopsuin'). There were only a few errors in this subcategory, because it only covered the items of the active indicative present and past in the morphology test. Errors in personal suffixes were, however, difficult to place in the other subcategories. Thus it was considered justified to keep them separate.

(6) Dialectal inflection (e.g., 'talleroo' instead of 'talleroa' / 'melskas' instead of 'melskasi' / 'töntöö' instead of 'töntöä' / 'atvas' instead of 'atvasi'). Dialectal inflection appeared mainly in two morphological forms - the partitive and the active indicative past.

For category IV, concerned with errors in the mastery of stems, the following subcategories were formed:

(7) Stimulus word changed into colloquial one (e.g., 'naulassa' instead on 'kourussa' / 'laukussa' instead of 'vetkässä' / 'leikki' instead of 'melskasi' / 'lujasti' instead of 'pääsösti').

(8) Stimulus word changed into another artificial word (e.g., 'lumpsii' instead of 'nopsii' / 'putakossa' instead of 'potelissa' / 'luikua' instead of 'suikulaa').

(9) Letter and/or syllable added to stem (e.g., 'hepsasesti' instead of 'hepsasti' / 'aarnutan' instead of 'aarnuan' / 'rujusivat' instead of 'rujuivat' / 'suikuloita' instead of 'suikulaa' / 'luirukkain' instead of 'luiruin').

(10) Letter and/or syllable left out from stem (e.g., 'uljasti' instead of 'uljakkaasti' / 'öyrin' instead of 'öyrikin' / 'lirputaan' instead of 'lirputetaan' / 'upissa' instead of 'upitessa').

(11) Syllable/letter in stem changed into another (e.g., 'häkkärempi' instead of 'häkkärämpi' / 'upetessa' instead of 'upitessa' / 'moiskii' instead of 'maiskii' / 'töylösti' instead of 'töylesti').

(12) Category V contained errors in which error both in suffix and stem occurred at the same time (e.g., 'kaikista luirusempi' instead of 'kaikista luiruin' in which the syllable '-se' has been added to the stem and the suffix of another form used / 'on kupsuttu' instead

of 'kupsitaan' in which the '-i' in the stem has been changed into '-u' and at the same time the suffix of another form has been applied to it).

Means and standard deviations of the error responses in each subcategory (as well as the percentages of the main and subcategories) were calculated from the pretest data for each age-group. The differences between the age-groups in the error categories were analysed by one-factor analysis of variance. Two-factor analysis of variance was used for examining the changes in erroneous responses caused by training and the relationships between linguistic errors and the children's cognitive level of development. The intercorrelations of the errors and their connenctions with some variables describing children's cognitive developmental level were also analysed correlatively.

3.3.2. Results

The reliability of the classification

The reliability of the classification was estimated by taking a random (10%) sample of the responses from the pretest (with 232 errors) which was then independently classified by two raters according to the above-mentioned instructions. The agreement was good; the average correlations between the scores was 0.92. In the classification of inadequate responses, the raters were completely concordant. The same was true with subcategories 7, 9, 10, 12, concerned with suffix and stem errors; the correlations varied from 0.90 - 0.99. Some differences between the raters were found in subcategories 8 and 11 (0.85 - 0.87) in answeres (e.g., 'moiskii' instead of 'maiskii' / 'etiompi' instead of 'atiompi' etc.) in which the rater had to decide whether the stimulus word had been changed into another artificial word or a letter or a syllable had been changed into another. In the final classification the latter alternative was accepted.

Reliability of the error variables

The reliability of the 12 error variables in each age-group was estimated by the split-half method. The category (1) of inadequate responses had the highest coefficient (0.81 - 0.96) in all age-groups. The reliability coefficients in the subcategories of suffix errors (2-6) were satisfactory (0.51 - 0.67) excluding two subcategories (partly correct suffix and dialectal inflection) in which the reliabilities remained in all age-groups lower than in the other subcategories of suffix errors. The low reliability was partly influenced by the fact that these errors only appeared in some morphological forms: partly correct suffix in the adverb and the comparative; dialectal inflection mainly in the partitive and active indicative past. Consequently, the number of items was too low for a reliable estimation of these variables.

The reliabilities of stem errors (subcategories 7-11) and of errors both in suffix and stem (12) were lower than those of suffix errors. The reliability coefficients showed remarkable variation between the age-groups and the subcategories. The low number of erroneous responses within each subcategory and this associated with the differences between the morphological forms explain partly the low reliabilities. Thus only rough conclusions related to these subcategories can be drawn on the basis of the present data.

The intercorrelations of error variables

The associations between the 12 error variables in each age-group were analyses correlatively. In some cases the data, because of skewed distributions of the error variables, did not fulfil all the requirements for parametric methods (McNemar 1962). Taking this restriction into account, the correlations did, however, show some general clear trends. Several developmental differences in the correlation of the various types of errors were found. The positive correlations in the subcategories of suffix and stem errors were higher in 3- than 4- and

5-year-olds; thus in 3-year-olds 20 of 55 coefficients exceeded the significance level $p < .05$, while the corresponding figures for 4-year-olds were 6 out of 55 and in 5-year-olds 5 out of 55. In 3-year-olds the correlations between stem errors in subcategories 8-11 were especially significant ($p < .01$) and were highly correlated with some suffix errors (such as partly correct suffix, error in personal suffix and dialectal inflection). Similar positive correlations in stem errors were also found in 4-year-olds but no longer between stem and suffix errors. The errors of 5-year-olds were more specific; the correlations between the error variables were low.

Erroneous responses in the pretest

Table 10 presents the means and standard deviations of the erroneous responses in the different subcategories and Figure 8 describes the percentages of the correct and incorrect responses and the distribution of errors into different categories in each age-group. Inadequate responses were found mostly in 3-year-olds; they constituted almost 70% of all the erroneous responses. The number of these errors decreased linearly as a function of age.

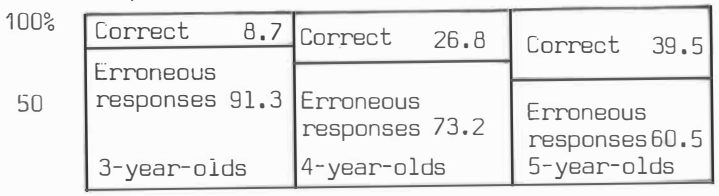
The difference between the age-groups in this error category was very significant ($F=18.25$, df 2/69, $p < .001$; the difference between 3- and 4-year-olds and 3- and 5-year-olds was significant on .1 and between 4- and 5-year-olds on .5 percent level). The age-groups differed also in the category of stem errors ($F=8.60$, df 2/69, $p < .001$). Three-year-olds made fewer errors in this category than 4- and 5-year-olds. The difference between 3- and 4-year-olds and 3- and 5-year-olds was a significant $p < .01$. Four- and 5-year-olds did not differ from each other in this category. Statistically significant differences between the age-groups were not found in the categories of suffix errors nor in suffix and stem errors.

The profiles of the separate subcategories of suffix and stem errors corresponded to each other in all age-groups. The largest error

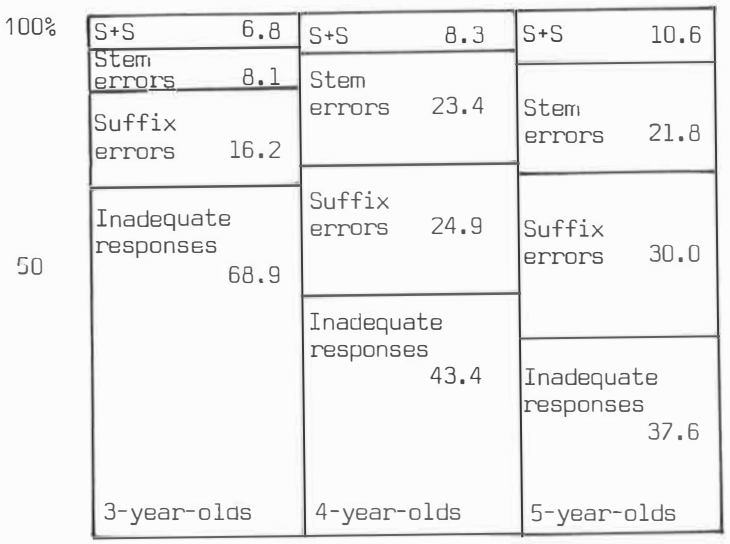
Table 10. Means and standard deviations of the error variables in the pretest

Error variables	3-year-olds		4-year-olds		5-year-olds	
	$\bar{X}$	s	$\bar{X}$	s	$\bar{X}$	s
1. Inadequate response	32.71	14.35	18.87	10.25	12.67	9.32
2. Partly correct suffix	0.54	1.65	0.12	0.33	0.17	0.37
3. Suffix of another morphological form	3.62	4.85	5.04	3.53	4.67	2.81
4. Stimulus word repeated without suffix	4.58	4.95	3.08	3.20	2.62	2.77
5. Error in personal suffix	0.71	0.89	1.58	1.08	1.29	0.93
6. Dialectal inflection	1.00	1.12	1.54	1.04	1.62	1.18
7. Stimulus word changed into colloquial one	1.92	2.10	2.00	1.55	1.16	1.37
8. Stimulus word changed into another artificial word	0.29	0.61	0.42	0.99	0.37	0.86
9. Letter and/or syllable added to stem	1.08	1.29	2.62	2.21	3.08	2.10
10. Letter and/or syllable left out from stem	0.46	0.76	1.46	1.44	0.87	0.88
11. Syllable/letter in stem changed into another	0.79	1.12	2.25	1.94	2.25	1.36
12. Both suffix and stem error	1.87	2.01	1.92	1.71	2.12	1.56

The percentages of the correct and incorrect responses



The distribution of errors into different categories



S+S = both suffix and stem errors

Figure 8. The percentages of the correct and incorrect responses and the distribution of errors into different categories in the pre-test among 3-, 4- and 5-year-old children

subcategory contained responses in which the suffix of another morphological form was added to the correct stem (39.8 - 48.3%), e.g., the comparative ending was used in forming the superlative, or the past tense was replaced by the active indicative present. Stimulus words repeated in their basic form appeared mostly in 3-year-olds (34.5%), whereas the corresponding amount in 5-year-olds was 18.1%. 5-year-olds (16.8%) and 4-year-olds (15.0%) produced more dialectal inflections than 3-year-olds (9.0%).

Responses in which a letter and/or a syllable was added to the stem formed the largest subcategory of stem errors (26.3 - 35.3%). These errors mostly occurred in 5-year-olds who also had a tendency to change the stimulus word into another artificial word (12.8%) more often than the other age-groups. The differences between the frequencies of dialectal inflections and stem errors showed that 5-year-olds changed the stimulus words differing from the present-day language into colloquial forms more actively than the other age-groups.

The changes in the error categories related to training

The absolute amount of errors decreased permanently in all age-groups from the pretest to post-test II. The changes in the erroneous responses were both quantitative and qualitative. Training decreased the amount of inadequate responses and the errors were transmitted to more specific subcategories of suffix and stem errors which were closer to correct responses. The training homogenized the performances of the different age-groups so that the percentages of suffix errors, stem errors, and both suffix and stem errors in the five-times-trained groups of 3-, 4- and 5-year-olds agreed with one another in post-test II.

A significant interaction of age and training in post-test II was found in categories inadequate responses, and suffix errors ($F=4.22$, df 4/63, $p<.01$ and $F=3.76$, df 4/63, $p<.01$). The clearest changes associated with training were in the group of 3-year-olds. The control

group and the five-times-trained experimental group of 3-year-olds differed significantly from each other in the categories of inadequate responses ($p < .05$), stem errors ($p < .05$), and both suffix and stem errors ($p < .10$). Moreover, the difference between the three-times-trained group and the control group was significant in the category of inadequate responses ($p < .05$) and suffix errors ($p < .05$). In 4- and 5-year-olds the differences between the groups were not as clear as between those of 3-year-olds. The five-times-trained experimental group of 4-year-olds produced significantly less ($p < .05$) inadequate responses than the control group. In the other categories, statistically significant differences between the experimental and control groups did not appear among the older subjects.

The changes related to training in the separate subcategories of suffix and stem errors

Responses in which the ending was replaced by the suffix of another morphological form were the largest group of suffix errors in the pretest. Through training, the proportions of these errors decreased in all age-groups. Most of all the errors appeared in the five-times-trained experimental group of 3-year-olds, which more often than the other groups applied the suffixes they had learned in wrong contexts (post-test I 32.4% and II 23.1%). This indicates that highly trained 3-year-olds overgeneralized more and combined the morphological forms incorrectly more than the other groups. In both post-tests the subcategory of stimulus words repeated in their basic form was the largest of suffix errors among all age-groups. However, in the pretest this was not the case. In the experimental and control groups of 3-year-olds the percentages of these suffix errors varied from 60.4% to 73.8%; in 4-year-olds from 44.5% to 52.5% and among 5-year-olds from 40.9% to 51.6%.

The increasing number of stimulus words repeated in their basic form in the post-tests was a result of the decreasing number of inadequate

responses in that these errors were transmitted to another subcategories. The stimulus words repeated without suffix represented the first transition stage on a dimension ranging from a completely wrong response to the adequate production of a morphological form. This also explaines the greater proportion of errors in the basic forms in many inflections among the youngest group rather than in the older groups. The technical restrictions on presenting the plural partitive of adjectives influenced the appearance of this subcategory among the older subjects (cf. p. 48).

In post-test II there were no differences in the experimental and control groups between the percentages of dialectal inflections and error in personal suffix. Partly correct suffix was rare even in the pretest among all age-groups. The experimental groups lacked these errors totally in post-test II.

The only obvious change in stem errors between the pretest and post-test II was observed in the subcategory concerned with the use of colloquial words, in which the number of errors decreased in all age-groups. Among 3- and 4-year-olds the decrease was a function of the amount of training. These errors appeared, however, most of all among 3-year-olds who more easily than the other groups identified themselves with the events on the picture cards and answered the experimenter's questions with colloquial utterances ('eilen minäkin leikin', yesterday I played, too, etc.).

The connections between linguistic errors and some variables describing children's cognitive level

The children's cognitive level of development was estimated by the C-series of the KTK performance intelligence scale, by a vocabulary test, by tasks measuring short-term memory (tests with different contents like numbers, sentences, letters, words, visual ones and task memory) and by analogy tests (verbal analogies, tasks of block and picture analogies, Raven's Progressive Matrices Test). The tests were

aimed at receiving information about a child's cognitive processing, mainly in the mastery of auditive, visual and performative types of short-term memory tasks and linguistic and performative analogical reasoning tasks. Only some of a child's cognitive skills were thus reached, e.g., tasks on orientation, discrimination and long-term memory were not included in this study. The connections between these types of tasks and the mastery of morphological forms will be examined later.

In each age-group the subjects were first divided into three groups corresponding to their developmental level according to the standardized sums of test scores. Level I included in each age-groups subjects whose scores were in the lowest third in the cognitive tests. Level III included subjects whose scores were in the highest third. Table 11 presents the percentages of the response categories at each developmental level in the pretest.

The results from the analysis of variance indicated that the main effect of the developmental level in the pretest was very significant in the amount of correct responses ($F=21.47$, df 2/63, $p < .001$) and in the category of inadequate responses ($F=10.63$, df 2/63, $p < .001$). In all age-groups subjects on level III produced more correct responses ($p < .01$) and fewer inadequate responses ($p < .05$) than group I. The examination of the results in each age-group proved that group III in 3-year-olds, who had performed the cognitive tasks well, produced more errors belonging to categories of suffix and stem errors than group I. In the category of stem errors the difference between groups I - III was significant ($p < .05$). Among 4- and 5-year-olds no statistically significant differences between developmental groups I - III were found in these error categories.

The correlations between the error and cognitive variables are given in Appendix 2, Tables 1, 2 and 3. The interpretation of the results is mainly based on the examination of the correlations between tests of memory and analogical reasoning and error variables. When explaining the correlations it must be observed that the errors were of different qualities. The children's erroneous responses formed a dimension ranging from completely wrong responses to almost correct forms. Stem errors were qualitatively 'good' errors because the suffix

Table 11. The percentages of the response categories at each developmental level in the pretest

Age-groups	Response category	Developmental groups I	II	III
3-year-olds	Correct responses	3.2	8.6	14.3
	Inadequate responses	75.9	60.6	45.1
	Suffix errors	13.7	20.4	24.3
	Stem errors	5.1	6.5	12.7
	Both suffix and stem errors	2.1	4.9	3.5
4-year-olds	Correct responses	15.7	22.9	33.6
	Inadequate responses	46.1	36.8	22.0
	Suffix errors	21.3	19.9	21.8
	Stem errors	13.4	17.4	18.3
	Both suffix and stem errors	3.5	3.0	4.4
5-year-olds	Correct responses	28.0	39.1	50.0
	Inadequate responses	35.2	23.6	11.6
	Suffix errors	16.0	17.8	23.8
	Stem errors	15.7	14.6	12.7
	Both suffix and stem errors	5.1	4.9	1.9

of the morphological form was correct; the error was only in the inflection of the stem.

Suffix errors also described some sort of mastery of the morphological form. For example, in partly correct suffix, errors in personal suffix, and in dialectal inflections, the erroneous ending differed only slightly from a correct one and did not prevent the comprehension of the matter. But the use of another form and repetition of the stimulus words in their basic forms can be seen as qualitatively worse errors than the previous ones, since they often changed the meaning and made it more difficult to understand the item. Inadequate responses revealed that the child had not yet mastered the required form, and

he thus could not act acccrding to the instructions given during the measurement.

The correlations between the number of correct responses and the cognitive test results were positive for all age-groups. In 3-year-olds 7/14, in 4-year-olds 10/14 and in 5-year-olds 9/14 coefficients exceeded the $p < .05$ level. It was further observed that the correlations between error and cognitive variables among 3-year-olds were positive - excluding the category of inadequate responses. Significant positive correlations were found between memory tasks (especially task memory) and the mastery of the vocabulary, and between suffix and stem errors. Moreover the correlations between tasks measuring analogical reasoning and stem errors were high among 3-year-olds.

Similar connections were found among 4-year-olds. Short-term memory tasks correlated significantly with errors in personal suffixes. The correlations between memorizing a sentence and stem errors (subcategories 9-11) were significant. Such connections were no longer observed among 5-year-olds. In this age-group, correlations between errors and cognitive variables were in most cases negative.

The results imply that in 3-year-old children and still partly in 4-year-olds, who are at the stage of suffix acquisition, the overgeneralization and incorrect combinations of the already acquired endings are proof of verbal activity connected with children's cognitive development. Among 5-year-olds, the interpretation is the opposite, caused by the difference in starting level of linguistic and cognitive skills. At this age, the cognitive performance exceeds the level necessary for mastering basic linguistic morphology.

3.3.3. Discussion

This study analysed linguistic errors made by 3 to 5-year-old children, the changes in the errors being considered as a function of training and age. The correlations between linguistic errors and some variables describing children's cognitive level of development were also examined.

The criterion for the choice of the error variables was that the errors should be categorized to cover the whole test, and in order to exclude other subcategories, it should be possible to describe the errors in detail and to classify them easily. This was successfully done. The only exception was errors in personal suffixes, which could only appear in verbs, in the active indicative present and past.

Linguistically the classification was not quite sufficient. Proceeding from the basis of a more specially linguistic classification, MacWhinney (1978), among others, has paid attention to the errors in the speech of children when examining the acquisition of morphophonological rules in different linguistic communities. In this study MacWhinney observed successes and errors in the learning of various allomorphs and the rules affecting the phonetic qualities of the allomorphs to be inflected, e.g., the spesific shape of irregular inflectional forms. This makes it possible to attack the problem of how children can acquire the mastery of exceptional inflections (e.g., Finnish consonant gradation). Such an approach in the present study would have presupposed, however, quite a large number of stimulus words systematically varied according to this aspect.

The cognitive theory (Sinclair 1971, 1973b; Slobin 1973) emphasizes that children do not learn the inflections of their mother tongue simply by copying, but that children up to the limits of their cognitive structure form at each age-level their own linguistic set of rules according to which they act in new situations. According to Inhelder, Sinclair & Bovet (1974) wrong behaviour is an essential and necessary part of child behaviour since correct performances can only be achieved through certain errors.

The result of the error analyses agreed with those of Cromer (1968) ano Beilin (1975) in that correct performances are achieved stage by stage. Inadequate responses formed one extreme end of wrong behaviour from which through suffix and stem errors correctly produced forms were acquired. The number of inadequate responses decreased through training in all age-groups and the errors were transmitted to the specific subcategories of suffix and stem errors which are closer to correct responses. The clearest changes in erroneous responses were found in the three- and five-times trained experimental groups of 3-year-olds. The percentages of the categories in the control group

of 3-year-olds remained, on the contrary, almost the same from the pretest to post-test II.

In 3-year-old children, whose inflectional forms are just developing, the positive correlations between the error and cognitive variables were clearer than in the other age-groups. Three-year-olds who had performed well in the cognitive tasks made more suffix and stem errors than the other groups. They also made fewer inadequate responses than 3-year-olds with lower cognitive scores. In 5-year-olds the correlations between suffix and stem errors and cognitive variables were in most cases negative. These errors among the older subjects implied that their mastery of the morphological forms did not correspond to the average performance of their own age-group.

Suffix and stem errors are, especially in the youngest age-group, evidence of not lower, but higher levels of language learning. This is because in order to make such errors, the child must understand the task, process both the stem and the suffix and attempt a relevant response. 4- and 5-year-olds, who had not yet mastered these skills, reacted in the morphology test by repeating the stimulus words in their basic form and by using colloquial words in their responses. 3-year-olds reacted more narrowly; their typical error was an inadequate response. Words repeated in their basic form and correctly produced colloquial words indicated that the children were - to some degree - cognitively prepared to react according to the instructions given in the situation.

The achieved results are suitable as they provide some of the first data on linguistic errors among Finnish children and their relationships to children's cognitive level of development. The generalization of the results presupposes, however, an extensive additional study to repeate the results and to confirm the preliminary conclusions reached in the present study based on a quite limited number of observations. It also seems necessary to include younger (18 months to 3 years old) age-groups in the study as well as to collect, besides the test responses, data about linguistic errors in children's spontaneous speech. Categorizing errors according to other criteria e.g., stressing the linguistic aspects more, is also valuable for a more complete analysis of early language-learning.

The erroneous utterances produced by children should be examined in view of the pecularities of the dialect which the child has learned in his nearest environment. Attention should be paid to the specific utterances (slang words, incomplete dialectical inflections) used by linguistic subcultures and to how these should be related to the standard language defined by grammar. Errors belonging to these groups are, however, difficult to define as no analysis of the concept 'error' has been performed. In Finnish, normative information defined by grammarbooks such as that of Penttilä (1963) can be used as a criterion for correct performance as was done in this study. It is possible, however, that grammars are not always able to define the prevailing use of language appropriately. Furthermore, other criteria for errors can be considered, e.g., the criteria can be associated with the comprehensibility of the expression. Consequently, sociolinguistic analysis of the concept of children's error is urgently needed.

Whether the language used in a child's home is the same as the one used at school is a central question concerning the child's success at school. The studies carried out under Bernstein's (1971, 1973) leadership indicate that when linguistic codes differ greatly, children have more difficulties in school than do the children whose language at home is the same as in school. This leads to the problem of the relationship between the child's language learning and the linguistic and cognitive guidance which the child gets from his parents and other adults in his immediate surroundings. This problem is considered in the following part of the present study.

3.4. On the relations between the linguistic and cognitive skills and the environment of 2-year-old children

Study 4 (Lyytinen 1975, 1976) examined the relations between the linguistic and cognitive skills and certain aspects of the environment. On the basis of earlier research data, it was assumed that (1) the mother's methods of guidance, (2) communication models, (3) ways of

reinforcement, (4) flexibility of interaction and (5) opportunities for action and learning offered by the environment are related to the linguistic and cognitive skills of 2-year-old children. The study also examined the extent to which environmental variables are stable predictors of linguistic and cognitive skills.

3.4.1. Method

Subjects

The subjects were 28 mother-child pairs. The children whose ages ranged from 1 year 8 months to 2 years 8 months (mean = 2 years 3 months) were from kindergartens in the city of Jyväskylä. Half of the children were girls and the other half boys. Twenty-one of the children were only children in their families, five children had one sibling, and two children had two siblings. All the mothers in the study with a mean of 27 years were in full-time work outside home. The mothers were from skilled working-class and student families.

Collection of the data

The data was collected in three parts. Firstly, the pretest-level measurements for the children's linguistic and cognitive skills were run individually in the kindergartens. Then the mothers were asked by letter to participate in the continuation of the study (28 of 30 mothers accepted the invitation). Mother-child interaction was then video-taped in a structured three-part task situation. During the same visit to the laboratory, background information about the children's environment was also collected from the mothers through interviews and questionnaires. The children's linguistic skills were measured eight months later.

Tests and procedures

The measures for the children's linguistic and cognitive skills. The children's linguistic skills were measured by five types of tests. The tests were: (1) a passive vocabulary test, (2) a test for the comprehension of morphological forms, (3) a test for the production of morphological forms, (4) test of skill in following verbal instructions and (5) sentence repetition test. Morphology tests were emphasized because previous information about how 2-year-old children master the comprehension and production of Finnish inflections was no available.

Cognitive skills in perception, reasoning, and remembering were measured with tests of (1) perception of similarities, (2) comparison of size, (3) mastery of the concept 'quantity', (4) distinction between the biggest/smallest thing, and (5) short-term memory. The construction, use, and suitability (to each age-group) of the tests have been reported on separately (Lyytinen 1975).

The observation of mother-child interaction. The observation of the dyadic interaction was carried out in a structured situation with three different tasks (picture cards, books, and a puzzle). The criterion for choosing the tasks was that they should be suitable for the developmental level of 2-year-old children and that they should provoke various verbal and non-verbal forms of communication.

In the picture card task, the mother was asked to present the questions on the cards to her child ('show me which picture has strawberries', 'show me which leaf is similar to this one', 'show me which girls is the happiest of all', etc.). The children's responses to the picture cards were classified as right or wrong. The second task was an informal situation looking at illustrated books. One of the two books was chosen because it contained separate pictures of animals and the other was chosen because it was a story with a plot. The third task was a puzzle in which the children were to find the correct places for ten fairy-tale characters of various shapes and sizes. The instructions urged the mothers to act in the same way at home when performing similar tasks with the child. Twenty minutes had been reserved for each pair in the video-tape recording.

The interview and questionaire data from the mothers. Information on the following features of the children's environment was collected by interviewing the mothers: (1) background information about the mother's education, work, size of family, (2) previous arrangements for the child's day care, (3) social mobility of the family, and (4) quantity and quality of the child's toys and his prevailing play behaviour.

After the interview the mothers were asked to fill in a form inquiring into the following areas: (1) the mother's behaviour for problematic situations in child guidance (13 questions), (2) the amount of time spent daily with the child and (3) the child's favourite games. Areas 1 and 2 are specified on page 73. Area 3 was examined by asking the mothers to estimate 11 different games and to say how often and how willingly their children played them if suggested by an adult. Some of the games the child could play alone, some presupposed the presence and guidance of an adult (e.g., puzzles and construction games).

The examination of play behaviour was considered important since play is a prevailing activity in childhood which at the same time reflects the level of cognitive skills mastered by the child (Liikanen 1969, Sinclair 1970, Saporozhets & Elkonin 1971, Aksarina 1972, Lowe 1975). Preference for different games was emphasized in the questionnaire since a young child's activities are to a great extent connected with behaviour patterns offered by the environment and performances guided by adults. Thus play also gives information about the different opportunities for activities offered by the child's environment (White & Watts 1973).

Interactional and environmental variables

Interaction was analysed globally. The central interactional variables were first sketched from the tapes as accurately as possible and then their appearance in each mother-child pair was estimated.

Interactional variables. The following areas were examined in mother-child interaction: (1) the mother's gestures towards the material during the tasks, (2) the mother's eye-contacts with the child, (3) the nature of the guidance in tasks (including instructions for tasks, both in acts of supporting motivation and in the handling of material), (4) linguistic interaction patterns and (5) the mother's way of rewarding the child. The flexibility of interaction, the spontaneity, and the good-humouredness of the mother's behaviour were further estimated as well as the amount of the mother's communication. Good-humouredness was considered to reflect the general atmosphere of the interaction. Table 12 presents the variables and their scoring.

Time correction of the quantitative variables isolated from the interaction proved necessary since the time used for the tasks varied greatly among the mother-child pairs (8-21 mins, mean = 12.1 mins). A time correction was arrived at after it was observed that the time used for presenting the tasks was as such not a significant distinctive factor in the subjects' interaction. In order to make the time correction, the subjects were divided into three groups so that the highest and lowest groups contained one and the middle group two quartiles of the subjects. After this, the score of each subject was examined in relation to the mean of his own group. If the score corresponded to the mean, the subject received two points. If the score was larger than the mean, he received three points and he received one point if the score was smaller than the mean.

Interactional mother-child behaviour varied in the task situations. Especially in the picture card task and in the book task ways of communication and task presentation varied markedly. The puzzle task showed less variation. Therefore an attempt was made to create a general measure representing different situations in the qualitative variables (mother's linguistic code, the nature of the guidance in tasks). The

Table 12. Variables describing the mother's interaction and the children's environment

Variables describing the mother's interaction

1. Number of mother's gestures towards the material (mother attempts to promote the child's performance with gestures of her head or hands e.g., by pointing several times at a certain part of a picture or at the contours of a picture)
2. The mother's eye-contacts with the child during the task
3. Non-verbal reinforcement (expressions, gestures, movements accompanied with a verbal sound 'hmm..', 'n..yy' etc.)
4. Comments ('niinpäs on' yes, it is, 'sinne meni' there it went, 'sillä lailla' that's the way)
5. Repetitions of the child's utterances in a corrected form of sentence ('se on kukka, joo' yes, it is a flower)
6. Comments including additional information ('kukkahan siinä, iso punainen kukka' yes, it's a flower, a big red flower)
7. Verbal reinforcements directed towards the child's correct performance ('oikein, sehän meni hienosti', 'kyllä sinä osasit' right, that was fine, you did very well)
8. Variation in mother's intonation when communicating verbally with the child (mother attempts to focus the child's attention to certain things with changes in intonation)
9. Explanations in mother's speech supporting the child's correct performances[x] ('katsopas, kyllä tuo tyttö on iloisin, kun sen suukin on noin hymyssä, nämä toiset tytöt eivät naura niin paljon' Look here, that girl must be the gayest because she's got a big smile on her face, these girls are not laughing so much)
10. Adequate guidance in tasks (giving instructions, motivating to tasks, handling the material during the tasks)
11. Estimation of mother's interaction: Amount of mother's communication (how much she talks during the time used)
12. Flexibility (how easily the mother can change her behaviour depending on the interactional situations)
13. Openness and spontaneity (how natural mother's behaviour is)
14. Good-humouredness (how well the mother maintains her humour in situations which do not proceed in an expected way, e.g., the child is not interested in the tasks or cases when the child fails several times)
15. Co-operativeness (to what extent the mother when presenting the tasks takes account of the child's initiatives for the order and way of presenting the tasks)
16. The mother's linguistic code. The utterances were divided into three categories 1) showing, naming, 2) describing the functional and qualitative characteristics of things and items, 3) comparing characteristics, explaining events, describing causal relations

x) These explanations occurred if the child could not answer the mother's question or if he answered incorrectly

Table 12. (continued)

Variables describing the children's environment

17. Social status of the family
18. The mother's explanations of the use of time, if she had an opportunity to get more time with the child awake (how she would use it)
19. Number of toys used by the child
20. Quality of toys used by the child
21. Most important characteristics taken into account by the mother when buying new toys for her child
22. The mother's use of time when the child is awake
23. The mother's satisfaction with her own work
24. Explaining behaviour towards the child in everyday problematic situations

Scoring of variables: Variables 1-9: the sum of frequency scores has been corrected with the time used for the task
Variable 10: each item estimated from 1-3 separately in picture card tasks, book- and puzzle tasks; the final score is the mean of the three tasks
Variables 11-15: estimated on scale 1-5. Variable 16: each task estimated with 1-3 points; the final score is the mean of the three tasks.
Variable 17: an already existing classification was used
Variables 18-23: scored on scale 1-3. Variable 24: the final score is the sum of the 13 tasks (each task received 1-4 points)

mean of the three tasks was thus used in the data analyses.

Environmental variables. These variables described the children's playthings, the mother's attitude to the significance of the toys, the mother's use of time with her child, and the mother's estimations of her work satisfaction. The mother's way of guidance was also evaluated, as well as the social mobility of the family. The toys used by the children were first divided into eleven main categories (traffic toys, drawing materials, dolls and doll articles, games etc.). Then the number of toys which each child had belonging to the different categories was estimated (variable 19). However, some of the playthings such as cars, crayons, tin soldiers, unserviceable household things were estimated as whole categories, because the mothers could not reliably remember the exact number of the toys in question. In estimating the quality of the toys (variable 20) possessed by the children, their

actional qualities were examined. The more things that could be done with the toy (combining different parts, comparing the relations between the parts as regards form, colour, and size, inventing new combinations) the better was the toy qualitatively. Toys which can only be watched, touched, and/or listened to do not give stimulus for learning new things as do toys containing several functions (Lahtinen 1971).

In inquiring about the most important qualities of toys, attention was paid to what extent the mothers took the developing qualities and the educational functions of the toys into account (variable 21). As regards the mother's use of time (variable 22) attention was paid to how much time the mothers used for the basic care of the child and for planning and guiding the child's plays. The descriptions of working conditions and mother's satisfaction with them and with the personal relationships at work were included in variable 23. Explaining behaviour to the child was rated by presenting the mother with simulated problematic situations occurring with a child every day (variable 24). Each situation included four alternative action patterns, of which the mother was to choose the one which she most probably uses in a similar situation. In the answers, attention was paid to how often the mother reported that she attempts to explain verbally to the child the causes and consequences of some action or event.

The mothers answered questions about the social mobility of the family by generally estimating the number of visits made to or by the family. Information on this area was left out in later analysis as it did not give any information about the character of the social contacts in the family.

Variables describing the children's interaction and their linguistic and cognitive skills. The definition and scoring of the variables are presented in Table 13. Information about variables 1-4 and 9-13 were collected with tests constructed for this study (Lyytinen 1975). The qualitative components of language use (variables 5-7) were analysed from recorded interactional data and the level of spontaneous speech (variable 8) during free communication in the testing situation. The cognitive level of games played (variable 14) was defined on the basis of mother's descriptions of the child's prevailing play-activities and his favourite games. The children's attentiveness, co-oper-

Table 13. Variables describing children's interaction and linguistic cognitive skills

1. Passive vocabulary test
2. Comprehension of morphological forms
3. Production of morphological forms (model)
4. Production of morphological forms (correctness)
5. Linguistic code. The child's utterances were divided into three categories 1) showing, naming, 2) asking, answering, 3) describing, explaining events and actions
6. Sentence structure of utterances: 1) one word utterances/repetitions of the same word, 2) incomplete two-three word sentences, 3) grammatically correct structures with three or more words
7. Many-sideness of vocabulary in interaction: 1) restricted vocabular/ repetition of the same words, 2) 1-2 different qualitative adjectives for things besides basic vocabulary and 1-2 verbs for various actions, 3) basic vocabulary awakened by stimulus pictures and spontaneously produced new nouns, adjectives, and verbs (at least three of each)
8. Level of spontaneous speech: 1) words in basic form, no inflectional endings, 2) distinction between singular-plural, two personal endings in verbs ('minä leikin', 'tuokin leikkii' I play, he plays too) at least two of the following case endings appear in the child's speech (the genetive, the partitive, the inessive), 3) in addition to the previous ones, the child's speech includes at least two tenses, three or more cases and inflection of adjectives ('olen tehnyt sen jo' I have already done it, 'hei, enkö istukin nätisti' aren't I sitting nicely, 'otan isomman palikan' I'll take the bigger block)
9. Comparison of size
10. Perceiving similarities
11. Mastery of the concept quantity
12. Distinction between the biggest/smallest thing
13. Visual memory
14. Cognitive level of games. The prevailing play-activities of the children were classified as follows: 1) simple games with cars, balls, and sand, often repeated in the same form, 2) looking at books, listening to fairy tales, drawing with crayons, using modeling wax, games of many forms with animals, dolls, trains, cars, repeated in different forms, 3) role and imagination games, building with bricks and blocks, various games using instruments and finger paints
15. Child's attentiveness in interaction (how attentively the child followed the instructions given by his mother)
16. Co-operativeness (how willing the child was to perform the task the way suggested by his mother)
17. Amount of communication (how much time during the tasks the child spent in speaking)

The instructions for scoring variables 1-4 and 9-13 have been presented in the report (Lyytinen 1975, pp. 8-12). Variables 5-8 and 14 have been scored on scale 1-3. Variables 15-17 have been scored on scale 1-5

ativeness and the amount of their communication were also estimated from the interactional data. The definition of these variables was based on the examination of the reciprocity in mother-child interaction.

Since the twelve-month age-range of the subjects caused significant differences in the children's linguistic and cognitive skills (Lyytinen 1975), an age-correction of these measures was necessary. For age-correction, the subjects were divided into two groups: 20-26 months and 27-32 months old. After this the score of each subject was examined in relation to the mean of his age-group. With the help of standard deviations, performances corresponding to the mean were given two points, those performing better received three points and those performing below it one point. Those who did not answer or answered completely incorrectly received zero points. Thus the new scores for each subject made possible the comparison of the results as the influence of age on the performances had been eliminated.

When analysing the data, age-corrected scores were used for linguistic-cognitive variables, the mean of three tasks for the qualitative variables with interactional data, and time-corrected sum scores for quantitative variables. The qualitative variables isolated from the mothers' and children's interaction formed a continuous dimension, in which for instance score 2 could only be achieved when the requirements for score 1 had been fulfilled.

Statistical methods. Correlation, factor, and regression analyses were used in analysing the results. Variables describing children's linguistic-cognitive skills and environments were factored separately to receive more reliable and orthogonal basic variables for continued analysis. Stepwise regression analysis was used to examine the connections between the variables. After an analysis on the factor level, a further analysis was performed with the separate central variables with high loadings in the factor analysis.

3.4.2. Results

The reliability of interactional variables

The reliability of the variables isolated from the interaction was estimated so that two persons scored a part of the video-tapes (six mother-child pairs) according to instructions constructed for this purpose. The reliability of the estimates for quantitative variables (eye-contacts, movements, and various ways of reinforcement) was examined by calculating the correlations between the raters. The reliability of the observations was good, the correlations varied from 0.91 - 0.97, being 0.95 on the average. The reliability for the qualitative variables in the interaction (e.g., characteristics of mother-child interaction, their linguistic codes, mother's adequate guidance in tasks) was estimated by calculating the percentage of agreement between the raters (Weick 1954). The reliability of the variables was satisfactory, the agreement between the raters was 83%. It is worth noticing, however, that in all the above variables the differences between the raters were only of one-class distance. Most differences between the raters occurred in the variable describing the mother's guidance in tasks. All points causing disagreement in this or any other variable were watched again on the video-tapes and the criteria for estimation were made more precise for further analyses of the tapes.

Intercorrelations of environmental variables

Intercorrelations of the variables describing mother interaction and those describing the children's home background are presented in Appendix 3, Table 4. The mother's verbal methods of reinforcement (variables 4, 5, 6 and 7) correlated significantly on $p < .05$ level with use of adequate guidance in tasks, and with the flexibility, spontaneity, and co-operativeness of the mother interaction as well as with the mother's linguistic code. On the other hand, correlations of non-

verbal reinforcement and the mother's movements (i.e., non-verbal communication) with these same variables were low.

The mother's eye-contacts with her child turned out to be a many-sided variable, correlating significantly with almost all variables describing mother interaction and her methods of reinforcement as well as with the child's environment. Mother's eye-contacts seemed to represent in a central way the intensity and purposefulness of guidance of the child in general. On one hand, eye-contacts had the purpose of controlling the child's behaviour, on the other hand, of guiding the activities. Similar observations on the importance of eye-contacts in interactions have earlier been presented among others by Moss & Robson (1968), Lewis & Goldberg (1969), Schmidt & Hore (1970), Beckwith (1972) and Tulkin & Cohler (1973). Adequate guidance in tasks and the mother's linguistic code also covaried moderately with other variables describing mother interaction.

The factor structure of environmental variables

Factor analysis was performed to make the information contained by the variables more concise. Before this, cross-tabulation was used to make sure that the single variables left out of the factor analysis carried no central information. Varimax-rotated factors can well be applied to the required multiple variable analyses, although unambiguous interpretation is often only possible when the intercorrelations of the variables are quite low (Sänkiaho 1974). The product moment coefficients, which were the bases for the analysis, are presented in Appendix 3, Table 4. The factorizings were formed by the principal-axis method and the rotations with varimax-method. The six-factor solution, on which the interpretation was based, explained 66.4% of the total variance in background variables (Table 14).

The most significant factors as regards the further analyses of the results were interpreted as factors of Mother's verbal interaction (I) and of Stimulus environment (II), of which the former explained

17.9% of the total variance and 26.9% of the common variance and the latter 10.2% and 15.4% respectively.

High loadings on Factor I were in the following variables: the mother's linguistic code, amount of communication, verbal reinforcement, (comments, comments plus additional information about the item), adequate guidance in tasks, and flexibility of mother's behaviour in interaction. The following environmental variables were emphasized on Factor II: quantity and quality of toys, most important qualities of toys according to the mother, and explaining behaviour to the child.

Factor III was called the factor of Non-verbal communication. Loadings on this factor were high for the number of mother's gestures towards the material, eye-contacts with the child, and variation in intonation. This factor explained 9.1% of the total variance and 13.7% of the common variance. Factor IV was called the factor of the Mother's positive guidance. On this factor the following variables describing the mother's behaviour were emphasized: openness, co-operativeness, good-humouredness, and the mother's methods of reinforcement, thanking for correct performances and repeating the child's utterances in a correct sentence. The factor described the mother's personal way of guiding and encouraging her child's behaviour in interaction. Factor IV explained 14.9% of the total variance and 22.5% of the common variance.

The last two factors were more ambiguous with regard to their interpretation. Tentatively, they can be conceptualized as factor of the Mother's satisfaction with her work (V) and a factor (VI) of the Mother's educational background. Their explanation was lower than that of the other factors, 7% of the total variance and 11% of the common variance. Student mothers were placed higher than working mothers in the grouping according to profession. They had, however, no real basis for answering consistently questions concerning their satisfaction with work. So formed variance in those items probably caused partly the interpretational confusion of the last factors.

Table 14. Rotated factor matrix of interactional and environmental variables

Variables	Factors I	II	III	IV	V	VI	h^2
1. Number of the mother's gestures towards the material	.06	.01	.78	-.07	.06	.02	.63
2. The mother's eye-contacts with the child	.18	-.23	.54	-.44	.47	.17	.81
3. Non-verbal reinforcement	-.09	-.20	.14	.10	.52	.03	.35
4. Comments	.67	-.08	.15	-.24	.12	-.04	.55
5. Repetitions of the child's utterances in a corrected form of sentence	.19	.01	.31	-.52	.16	.48	.66
6. Comments including additional information about the item	.68	.03	.34	.03	.11	.35	.71
7. Thanking for correct performances	.34	.20	.09	-.47	-.35	-.27	.58
8. Variation of intonation	.35	-.13	.64	-.28	-.09	-.02	.63
9. Explanations supporting the child's correct performance	.73	-.28	.18	.04	-.06	.16	.68
10. Adequate guidance in tasks	.67	-.14	-.08	-.58	.19	-.16	.88
11. Amount of the mother's communication in interaction situation	-.70	-.25	.33	-.33	.00	-.06	.77
12. Flexibility of the mother in interaction	.67	-.31	-.08	-.52	.13	-.01	.84
13. The mother open and spontaneous in interaction	.35	-.20	.51	-.60	.17	-.11	.82
14. The mother good-humoured in interaction	.12	-.09	.17	-.81	-.16	-.05	.74
15. The mother co-operative in interaction	.22	-.22	.15	-.79	-.00	.04	.75
16. The mother's linguistic code	.73	-.02	.05	-.41	.19	.23	.79
17. Social status of the family	.05	-.29	-.08	.03	.31	.60	.55
18. The mother's explanation for the use of time	.06	-.04	.01	.07	-.03	.69	.48
19. Number of toys used by the child	.22	-.83	.01	-.23	.25	-.05	.85
20. Quality of toys	.43	-.78	-.01	-.02	.20	.19	.88

Table 14. (continued)

Variables	Factors I	II	III	IV	V	VI	h^2
21. Most important qualities of toys according to the mother	-.07	-.60	.21	-.18	-.07	.45	.64
22. The mother's use of time when the child is awake	.24	-.16	.19	-.25	.48	.09	.41
23. The mother's satisfaction with her work	.20	.04	-.12	.05	.61	.06	.44
24. Explaining behaviour to the child	.29	-.42	.09	-.25	.21	.28	.48
% of total variance	17.9	10.2	9.1	14.9	7.1	7.3	66.4
% of common variance	26.9	15.4	13.7	22.5	10.6	11.0	100.0

Correlations between children's interactional behaviour and their linguistic and cognitive skills

The examination of the intercorrelations between cognitive and linguistic variables (Appendix 4, Table 5) revealed that comprehension of morphological forms and the passive vocabulary test scores correlated significantly (0.63). The activities for speech production also correlated with one another, the coefficients being .6 on the average. But the intercorrelations of comprehension with production were low.

The variables describing the children's communicative skills which were derived from the video-recordings were highly correlated with test scores on the mastery of morphological forms. By factorizing these variables in the same analysis, an attempt was made to examine the structure of linguistic skills when two different sets of variables related to linguistic behaviour are combined.

Among the cognitive tests, the tasks measuring visual perception (comparison of size, perception of similarities, mastery of the concept 'quantity' and distinction between the biggest/smallest thing) had quite

low intercorrelations. This can partly be explained by the weakness in the test score distributions. The tasks measuring the mastery of the distinction between the biggest/smallest thing and the concept 'quantity' were too difficult for the younger subjects. These tests were left out from factor analyses because of their weak discrimination ability (Lyytinen 1975).

The cognitive level of the children's games and the visual memory tasks correlated significantly with the children's performances in most of the linguistic and cognitive tests. The observed correlations between the memory test and the other test results were understandable since good performance in the test required remembering the instructions and the presented tasks. The cognitive level of the children's games correlated significantly with all other linguistic-cognitive tasks, save tests for comprehension and perception of similarities. Its correlations with the child's actively produced speech were specially clear. This indicates that, along with the development of linguistic utterances, the child's play activities also become more versatile. Among linguistic tasks, activities for speech production - mastery of the model for morphological forms and level of spontaneous speech estimated in the testing situation - correlated most clearly with the cognitive variables. The observed correlations indicate that a 2-year-old child capable of versatile linguistic utterances is also cognitively skilful.

The factor structure of children's linguistic-cognitive skills

The factor analysis of the linguistic-cognitive variables was performed by the principle-axis method and the rotation by the varimax-method. The interpretation was based on a 4-factor solution. Together the rotated factors explained 70.3% of the total variance (Table 15).

Factor I was called the factor of Speech production. High loadings were received by the model and correctness variables in the production test of morphological forms, by the level of spontaneous speech esti-

Table 15. Rotated factor matrix for the children's linguistic-cognitive skills

Variables	Factors I	II	III	IV	h^2
1. Picture vocabulary test	.14	.72	.14	-.24	.61
2. Comprehension of morphological forms	.13	.80	.04	-.04	.66
3. Production of morphological forms (model)	.81	.07	.29	.39	.90
4. Production of morphological forms (correctness)	.90	.21	.12	.20	.91
5. Linguistic code	.33	-.12	.08	.78	.73
6. Sentence structure of utterances	.23	-.26	-.14	.79	.76
7. Many-sidedness of vocabulary in interaction	.65	-.01	-.08	.63	.82
8. Level of spontaneous speech	.82	.27	.21	.38	.93
9. Comparison of size	-.07	.32	.65	.14	.55
10. Perceiving similarities	.10	-.16	.59	-.02	.38
11. Visual memory	.24	.29	.64	-.02	.56
12. Cognitive level of games	.37	.03	.40	.57	.62
% of total variance	24.8	13.1	12.8	19.6	70.3
% of common variance	35.2	18.6	18.2	28.0	100.0

mated in the testing situation, and by the child's versatile vocabulary in interaction. The grouping of the model and correctness variables on the same factor is partly technical; the variables are partial performances of the same test so that correctness demands the mastery of model. Model and correctness variables were, however, included in the same factor analysis after the decision was made to include the specific variation of each of these variables in the factor scores. Factor I explained 24.8% of the total variance and 35.2% of the common variance.

Factor II was called the factor of Speech comprehension. The comprehension of morphological forms and the passive vocabulary test had the highest loadings. The comprehension factor explained 13.1% of the total variance and 18.6% of the common variance.

Factor III was interpreted as the factor of Ability to conceptualize perceptions. Comparison of size, visual memory, and tasks for perceiving similarities were emphasized most clearly on this factor. Factor III explained 12.8% of the total variance and 18.2% of the common variance.

Factor IV was called the factor of Linguistic interaction. The code and sentence structure of the child's linguistic utterances in the interactional situation received high loadings. On this factor were also loaded the cognitive level of the children's games estimated from the mothers' descriptions. Factor IV explained 19.6% of the total variance and 28.0% of the common variance. Table 16 presents the intercorrelations of factor scores calculated from the rotated factor matrices of environmental variables and variables describing children's cognitive-linguistic skills.

Regression analysis of factor scores

Stepwise regression analysis was used in examining the extent to which background factors combined together would predict the variance of separate linguistic-cognitive factors. The source file in the analysis consisted of factor scores calculated from rotated factors. The prediction percentage of the variable combinations formed from the environmental factors varied from 19.4 to 41.0%. Although the predictions were not statistically significant ($p < .10$) on Factors II and III, the combinations of two prediction variables produced, however, a clearly better explanation than separate correlations.

The best prediction value was received by Factor I (Mother's verbal interaction) which correlated with all the criterion variables. Combined with Factor II (Stimulus environment) it predicted significantly the activities in Speech production (41.0%) and the Linguistic interaction of children (32.5%). Mother's verbal interaction (Factor I) together with factors of Mother's satisfaction with work (Factor V) and Non-verbal communication (Factor III) were connected

Table 16. Intercorrelations between the factors

Factors	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. The mother's verbal interaction		.05	.01	.06	.06	-.02	.53	.23	.40	.48
2. Stimulus environment			-.05	-.02	-.09	.13	.39	-.17	.03	.33
3. Non-verbal communication				.04	.03	.03	-.10	.41	-.16	.01
4. The mother's positive guidance					-.08	.00	-.11	-.11	-.00	.22
5. The mother's satisfaction with her work						-.01	-.08	.07	.22	-.22
6. The mother's educational background							.03	.01	-.08	-.01
7. Speech production								.09	.05	.11
8. Speech comprehension									.07	-.10
9. Ability to conceptualize perceptions										.01
10. Linguistic interaction										

$r \geq .31$, $p < .05$

$r \geq .42$, $p < .01$

to the Ability to conceptualize perceptions and Speech comprehension of children. The prediction value of these factor combinations remained lower than those of other criterion variables. This can partly be explained by the ambiguity of Factors V and VI.

The results from the regression analysis performed on each factor revealed that Factors I and II were the best predictors of the variance in the children's Speech production, their Linguistic communicative skills, and their Conceptualization of perceptions. On the basis of this analysis, it was not possible to estimate whether some separate variables which had received high loadings on Factor I had a better prediction value than the others. There also remained unanswered the question of to what extent the separate background variables of different factors combined together could predict the variance of criterion variables. These problems are examined next.

The prediction values of separate environmental variables

Regression analysis was also performed on separate background variables which had high loadings on the factors. Criterion variables were the same as in the regression analysis performed on factor-level predictions. The best combinations of two separate background variables predicted the variance of criterion variables as well as of two factors together. In fact, separate variables had somewhat higher multiple correlations to Factors III and IV than those of the factor level predictors (Appendix 5, Table 6). Factor II was the only exception on which the multiple correlation of the separate variable combinations remained lower than the prediction on the factor level.

The variables describing explanations supporting the child's correct responses, reinforcing comments and quality of the child's toys from the Mother's verbal interaction -factor and the child's Stimulus environment -factor combined together predicted significantly the variance in the Speech production (37.2%) of the children. The correlations of prediction and criterion variables show that adults who supply

the child with multipurpose play material also more probably take part in and guide the children's games. The favourable influences of verbal communication and guidance behaviour in games are reflected in the linguistic skills of children - in the mastery of spontaneous speech acts and the production of morphological forms.

Factor II - the factor of Speech comprehension - was the only one on which the prediction value of the variable combinations was not statistically significant in either of the analyses. The examination of the primary scores showed that in the comprehension and vocabulary tests only one third of the subjects received better scores than those received by guessing. This could have been influenced by the fact that the vocabulary test meant for 3- to 6-year-old children was too difficult for 2-year-olds. As regards the comprehension test, it was too long (36 items + 6 training tasks). The tasks were presented in two or in some cases in three parts. The children's interest decreased with the increase of presentation times. Thus the comprehension tests did not discriminate reliably enough amongst the performances of the children. This is indicated by the results from the remeasurements performed eight months later. On that occasion all the linguistic tests correlated significantly with each other and the comprehension test managed to reach the variation in the comprehension skills among children of this age more reliably than during the first measurement.

Factor III - Ability to conceptualize perceptions - was best predicted by the variable of explanations supporting the child's correct performances together with the variable of the mother's satisfaction with her own work and the reinforcing comments variable (multiple correlations 0.49 and 0.47). The last-named variables completed the multiple correlation only to a small extent as explanations supporting the child's correct performances also separately correlated with the criterion variable (0.43).

Factor IV - Linguistic interaction of children - could be predicted better than the second and third factors. The explanatory power of the three best variable combinations were almost equally good (38.4%-37.2%). Significant correlations were found between the children's communicative skills variable, the quality of toys variable, and the explaining behaviour to child variable (37.8%). The latter combined

with the flexibility of mother interaction variable (37.2%) and the mother's linguistic code variable together with the quality of toys variable (37.2%).

The results from the regression analysis further indicated that the prediction value of background variables was not specifically restricted to children's linguistic-cognitive skills, but that their correlations to children's attentiveness, co-operativeness, and amount of their communication were also significant. The differences in mother's communicative models and opportunities for activities offered by the environment may as such cause differences in the children's motivational and orientational behaviour, which can later appear as differences between children's linguistic-cognitive skills.

Prediction stability of environmental variables

The remeasurement performed eight months later examined the stability of the results and the reliability of the predictions. The children's mastery of linguistic skills was then estimated by tests measuring the comprehension and production of morphological forms and by tests measuring the ability to follow verbal instructions and to repeat sentences. In addition, the children were presented with an auditory serial memory task measuring short-term memory.

Regression analysis was applied to those new dependent measures. The combinations of two prediction variables in the remeasurement produced a clearly better explanation than the separate correlations. Except for the test of sentence repetition, multiple correlations were significant explaining 29.2-57.8% of the variance in the mastery of criterion variables. The separate variable combinations predicted best the test on producing morphological forms and the mastery of auditory serial memory, the percentages ranging from 42.2-57.8.

In the first measurement, the criterion variables to be explained were factor scores. In the remeasurement the corresponding variables were age-corrected scores from separate tests. For the sake of result

comparison, regression analysis was also done on the results of the first measurement for tests same in both measurements. In the test for production of morphological forms the prediction value of background variables remained almost the same from one measurement to another as regards model variable. For the mastery of correctness variable, multiple correlations were somewhat higher than in measurement I (measurement I 0.70, remeasurement 0.72).

Significant among separate background variables were mother's explanations supporting the child's correct performances and the quality of the child's toys, which, combined with other variables, predicted more often than on the average the mastery of linguistic skills eight months later. The prediction value of these variables had been established as significant at the first measurement. Mother's use of time appeared clearer in the remeasurement than in measurement I.

Explanations supporting the child's correct performances appeared among the mothers when the child was not able to answer the mother's question or answered it wrongly. Then the mothers' ways of reacting varied. Some mothers ignored the incorrect answer totally. Some mothers referred to the child's error without explaining it more fully and some explained the error in the answers emphasizing the facts the child should take into account in order to reach the correct solution. Adult participation in the child's games and the guidance they provided varied with the variable describing the quality of the children's toys. It was earlier considered that those activities affect children's linguistic skills positively. Obviously, the significance and stability of these separate variables is explained by the fact that they largely included the central variation which was observed in adult-child communication in general.

3.4.3. Discussion

This study was successful in discovering some variables describing the children's environments and their mothers' interaction, that tended to correlate with the children's linguistic and cognitive skills as well as their attentiveness, co-operativeness, and the amount of their communication during the tasks presented in the interactional situation. Significant in the interaction were the mother's linguistic code, explanations supporting the child's correct performances, reinforcing comments, flexibility of interaction, and eye-contacts with the child. Strongest among the environmental variables were the mother's use of time with the child, amount of explaining behaviour to the child in everyday problematic situations, and the quality of the child's toys. The prediction value of these variables was observed to last for eight months in remeasurement.

The results supported earlier observations that the mother's guiding behaviour and flexibility of interaction (Barbrak et al. 1970, Clarke-Stewart 1973, White & Watts 1973), the mother's ways of communication and rewarding (Wolf 1963, Hess & Shipman 1965, 1968; Cazden 1969, Bernstein 1971, 1973; Nelson 1973, Nelson et al. 1973, Waxler & Yarrow 1975) and the opportunities for activities and learning offered by the environment (Beckwith 1971, Wachs et al. 1971, Jones 1972, Nelson 1973, White & Watts 1973) are significant for a child's favourable development.

A global rating approach related to interactional mother-child behaviour was used because of the age of the children and the consequent nature of the interaction. Researchers who have analysed the sequences of dyadic interaction (Bell 1971, Lewis 1972, Brazelton et al. 1974, Lewis & Lee-Painter 1974) have emphasized that a child can with his own behaviour direct the interaction and influence its general tone. To examine these effects in the present study, a reduced sequential analysis of actions in the mother-child pairs was performed when they were looking at books. The results indicated that by this method a more detailed analysis can be made of adult-child interaction. Consequently, subsequent studies are concerned with how adequately behavioural sequences can be analysed when applying this approach and what is the

practical value of such analysis (Lyytinen, Pölkki & Rasku 1977).

When estimating the results of this study and whether they can be generalized to the actual mother-child interaction in general, restrictions related to the small number of subjects and to the short-term interactional samples should not be forgotten. A significant supplement to the observed behaviour would have been a nonstructured and relatively large sample from the subjects' behaviour in natural surroundings e.g., at the child's home. There was, however, no possibility of its realization because of limited resources. Further, it is worth noticing that only mother-child interaction was analysed in this study. The assumption was, however, that the observation of one of the parents gives information on the communication typical within the family (Davis & Lange 1973).

The age of the children influences the validity of the observed behaviour decisively. Most of the 2-year-old children reacted during the interaction in a way probably corresponding to their behaviour in other similar situations. It is possible, however, that mothers tended to show positive behaviour more than in similar situations at home. The natural behaviour and spontaneous initiatives of the children decreased the amount of such effects among the mothers. Thus, it may be justifiable to draw the conclusion that the now separated variables more generally represent the typical way a mother communicates with her child in corresponding situations, and that those ways have some bearing on the cognitive and linguistic development of the child.

By applying the results, an attempt can be made to change the environments so that they would include, more than today, characteristics for favourable interaction. In education this means that adult behaviour should also include, besides direct verbal communication, active participation and guidance of the child's games. When these forms of communication become a natural part of everyday adult-child behaviour as early as possible, it can be expected that the interindividual differences in children's linguistic and cognitive skills will gradually become narrower and children's possibilities of acquiring and using their mother tongue become maximized.

4. GENERAL DISCUSSION

4.1. Evaluation of the research methods

One hundred and forty (140) 2 to 5-year-old children of normal intelligence and linguistic skills participated in the studies. Two-year-old children were chosen subjects in the fourth study because the early stage of development is best for estimating the connections of adult guidance and various interactional patterns to language development. At that time language acquisition proceeds most quickly and the opportunities for environmental influences on a child's development are greatest.

Permission to examine the children in all studies was received from their parents. The number of refusals was small, less than 10%. This was partly influenced by the fact that almost all measurements were carried out in the kindergartens and the clubs so that the children's participation was naturally included in their daily programme. The subjects were girls and boys from skilled working- and middle-class families. An attempt was made to choose children of homogenous social background so that the results of children of different ages would be comparable. No special attention was, on the other hand, paid to sex, as earlier studies showed that the differences in the mastery of morphology were not significant (Berko 1958, Himberg 1967, Ruoppila & Liste 1967, Luukkonen & Ruoppila 1969, Malin & Ruoppila 1969, Graves & Koziol 1971, Selby 1972). The data was collected exclusively from Central Finland. However, the territorial limitation had the advantage that the colloquial language in Central Finland is in general closer to standard Finnish and so-called slang appears less than in southern part of Finland.

Picture card tests constructed for these studies by applying Berko's (1958) method were used for measuring the use of morphological forms.

The mastery of Finnish morphology - inflection of adjectives, verbs and nouns - was measured by 54 items in studies 1, 2 and 3. The morphological forms in the studies such as the various tenses, the plural partitive of adjectives, the formation of adverbs, the comparative, the inessive and partitive forms represented inflections generally appearing in colloquial speech. Only the superlative of adjectives was among the more seldom appearing forms. As there exists no precise information about the frequencies of the different morphological forms in spoken Finnish, the frequencies of those forms cannot be described more accurately. The morphology test constructed for 2-year-olds in study 4 was realized and presented in the same way as the one for older subjects. The difference was, however, that the number of items was smaller (16) and the stimulus words were familiar colloquial words. Both were necessary changes for making possible the adequate measurement of the linguistic skills of 2-year-olds.

The comprehension of morphological forms was also measured by picture card tests (Fraser, Bellugi & Brown 1963). The child had to choose from either two (study 1) or three (study 4) pictures the one in which the required thing or event appeared. The weakness of the method was that the child could randomly choose the correct alternative. The probability of guessing was great especially in study 1, in which it was possible that half of a child's correct answers were randomly given: thus the low reliability of the results restricted the interpretations and the drawing of conclusions. The erroneous responses in the comprehension tests could not be analysed either, since it was not certain whether the errors were based on erroneous conclusions or on guesses.

A subsequent analysis of the children's ways of responding indicated that it would be possible to estimate the proportion of randomly-produced responses in the comprehension tests in further studies. In general, the children who had mastered the morphological form responded immediately to the task. The children, to whom the required form was partly clear, started to think about the correct answer. By following the child's eyes, it could be concluded which of the alternative items he was comparing. The children, to whom the morphological form was unknown or who were completely uncertain about their responses, pointed at several pictures in turn trying to get reinforcement for their choices by

watching the experimenter's expressions. Thus guessing played an obvious part in the results.

Some further technical restrictions limited the generality of the comprehension tests. The pictorial representation of morphological forms was sometimes e.g., in the passive indicative present, difficult. The presentation of the tasks was as follows: The experimenter showed to the child a model picture in which the subject (person, animal, fairy figure) acted in some way. Besides the model picture, the child was shown two or three alternative pictures in which the hands, legs, or head of the subject were doing the same or a similar thing. The child was to choose the picture in which the action was similar to that of the model picture. In these tasks younger children made immediate comments such as 'on rikki' (it is broken), 'missä pää' (where head) etc. Difficulties in visualizing the tasks disturbed the linguistic comprehension of the utterances. Similar observations have been suggested by Brown (1976) according to whom actions connected to the passive cannot be completely represented in pictures.

Comprehension was measured in study 4 by a test of skill in following instructions as well as by the above-mentioned test (Shipley, Smith & Gleitman 1969). This method was more practical than comprehension tests. The observation of a child carrying out instructions given to him was a more reliable measure of comprehension than one in which a child had to choose the right one from alternative pictures.

The mastery of vocabulary was mapped in all age-groups by a passive vocabulary test (Ruoppila 1971), which was actually meant for 3 to 6-year-old children. Taking the age-restriction into account, the test was also used for 2-year-old subjects since it was the only Finnish test mapping the passive vocabulary of young children. The need for further studies is obvious as regards this measuring problem. In particular the methods for measuring the speech comprehension and production of under 2-year-old children are deficient. Tests for measuring the level of representational activities such as symbolic play and imitation (Rodgon 1976) should be planned for this age-group, too. Knowledge from this field will be received in the near future as the connections between representational activities and the comprehension and production of language among 12-18-month-old children are being studied by the present author.

4.2. Main results related to language acquisition

4.2.1. Mastery of morphology among 2- to 5-year-old children

Information regarding the pretest results of the present studies is summarized in the following by describing the mastery of morphological forms at various age-levels. A general observation was that the comprehension of morphological forms preceeded their production in all age-groups. The clearest developmental changes in comprehension were observed in the age-range 2-3 years. The corresponding change in the production of morphological forms occurred a year later, in the age-range 3-4 years.

For instance 2-year-old children understood 40.5% of the comparative forms, but could only produce 3.4% of them. The possibility of guessing in the comprehension test must be taken into account when interpreting the results. This does not, however, explain the observed difference. The test of size comparison presented to 2-year-olds (Lyytinen 1975) proved that most children of this age mastered the size differences of objects as a pair comparison. The mastery of this cognition may, on the other hand, explain the fact that 2-year-olds understood tasks of comparison, although the production skills of this morphological form were only developing. Study 1 indicated that the acquisition of the comparative in active speech happened a year later as the effects of training were clearest in this form among 3-year-olds.

The observation of the mastery of morphological forms in each age-group proved that 2-year-old children both comprehended and produced, cases better than other forms (inessive, plural partitive). One third of the 2-year-olds also understood tenses (passive indicative present and past) and could produce the present forms of the active indicative when familiar colloquial words were used as stimulus words. Most difficult for 2-year-olds were the comprehension of the superlative and the production of the comparative. The production tasks of the superlative were not presented to 2-year-olds at all because it was known on the basis of earlier results that the mastery of this morphological form is low even in 3-year-olds (2.8%).

Among 3-year-old children the level of comprehension of the morpho-

logy was clearly higher than in 2-year-olds. The percentages of correct responses ranged from 54-72%. 3-year-olds understood best forms of the comitative, and the passive indicative present and perfect (65% on the average). The comprehension of superlative forms also caused most difficulties among 3-year-olds. As said above, the mastery of producing the morphological forms was lower than that of comprehension. The percentages of the correct productions in the model variable ranged from 2.8-40.6%. 3-year-olds performed best on tasks of the inessive and the comparative. Erroneous responses mostly appeared in the production of superlative and adverb models.

Among 4-year-old children the percentages of correct responses in the comprehension test ranged from 68-90%. Their highest scores were in abessive forms. In those tasks some children (67%) achieved maximum scores. In the production of morphology the percentages of correct responses ranged from 14-74%. The scores of tenses (active indicative present, past, passive indicative present) the comparative, the superlative, the adverb and the plural partitive were doubled from 3 to 4-year-olds.

Among 5-year-olds the average percentages of the correct responses in the comprehension tests were 80%. Some subjects achieved maximum scores in the abessive (67%), the passive indicative present (57%), the comitative, and the passive indicative perfect (48%). The percentages of correct answers in the production test ranged from 21-91%. Completely correct inflections occurred in the comparative (77%) and the inessive (50%). Five-year-olds had the most trouble with the superlative and the plural partitive of adjectives. It is also noteworthy that 5-year-olds, whose level in the mastery of morphology was higher than that of the other age-groups used, more that 3- and 4-year-olds, dialectal colloquial inflections, and moulded words differing from present-day Finnish according to colloquial models.

Figure 9 summarizes Finnish research results dealing with the mastery of morphology at different age-levels (Himberg 1967, Ruoppila & Liste 1967, Luukkonen & Ruoppila 1969, Malin & Ruoppila 1969, Päivinen 1972, Lyytinen 1973, 1974, 1975; Ruoppila 1969, 1972; Viitasaari 1975). These studies were performed to get the necessary basic information about the development of the Finnish morphology in early childhood.

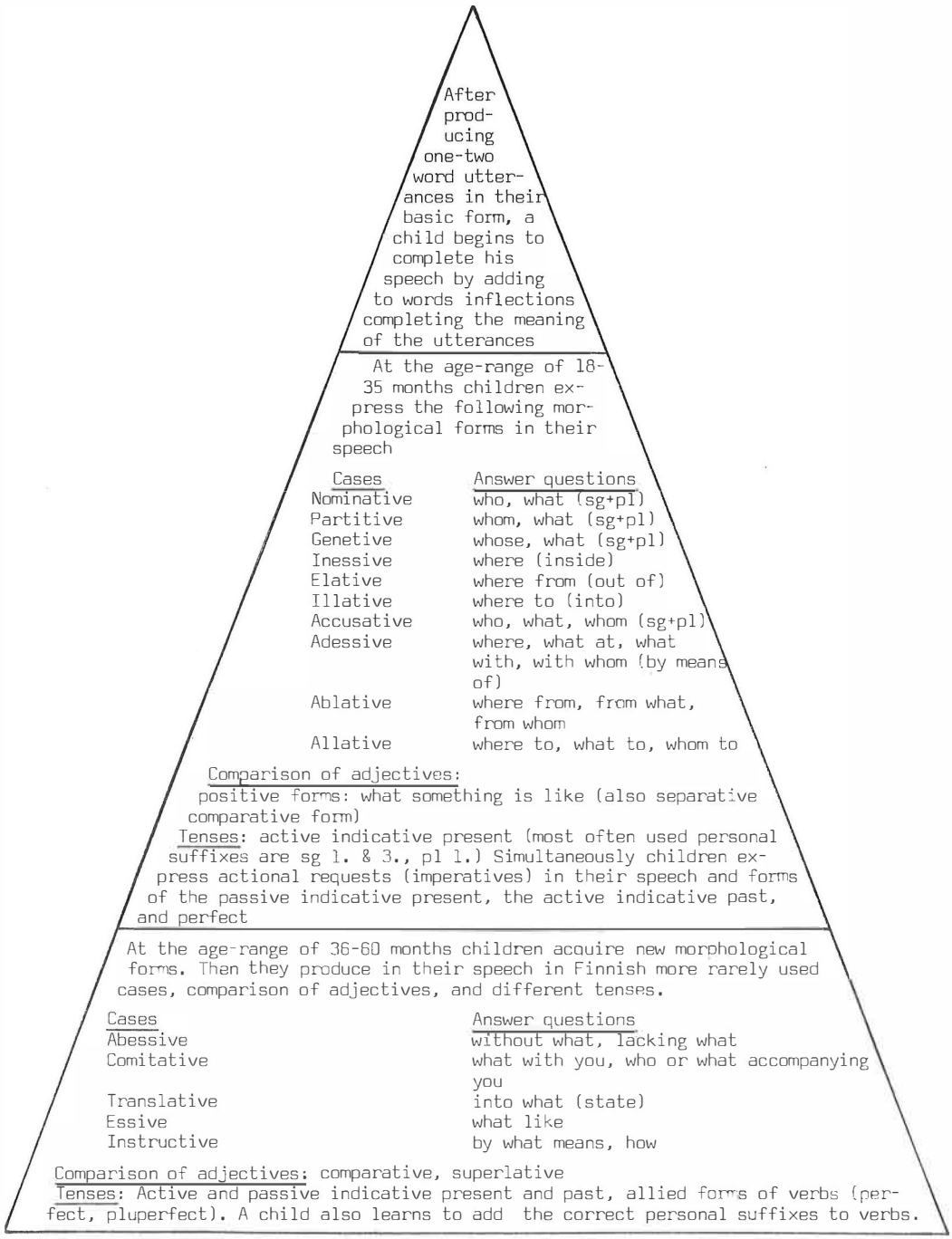


Figure 9. Acquisition of Finnish morphology during the first five years

The achieved results make possible the planning of further studies so that in them, approaching from the cognitive theory, psycholinguistically interesting and relevant items in various age-groups can be taken into consideration. The acquisition of syntactic rules and the connections of this linguistic field to the mastery of morphology and children's cognitive level of development at that time should also be examined in further studies.

When examining the mastery of morphological form in children at various age-levels it must be remembered that structured morphology-tests were used as the method for measurement. The words to be inflected in the tests were archaic Finnish words. Thus the children's responses primarily indicated how they could apply the inflections they had learned to words unknown in meaning. The skill of application of the form to new words implies that the child has very probably used the inflection in his spontaneous speech earlier.

Toivainen (1976) found when investigating changes in children's speech at the age-range of 1-3 years that the median of the first appearance of the past tense in Finnish children was 1 year 11 months and that of the perfect 2 years 4 months. Observations on the speech of 2-year-olds in interactional situations (Lyytinen 1976) also showed that their speech contained, besides the present tense, separate forms of the active indicative past and perfect, and the passive indicative present, as well as some of the cases often used in Finnish (the nominative, the genetive, the partitive, the internal and external locative cases). Brown (1973a), Cazden (1968) and de Villiers & de Villiers (1973) have pointed out that it may take more than a year from the first appearance of a morpheme to its consistent use in a child's speech. The before mentioned observations and the results obtained from the morphology tests agree with this suggestion.

Similar results about the mastery of morphology have also been received in cross-linguistic studies. E.g., Cromer (1968) and Brown (1973a) have presented comparable findings related to the correct use of the active and passive forms in a child's speech at the age of 4-5-years. Besides Finnish children, also Hungarian children (MacWhinney 1976) have early been observed to use plural and locatives (inessive, illative) in their speech. Brown, Cazden & Bellugi (1969) and Brown (1973a)

have found that the first prepositions which the English children begin to use in their speech sometime after the age of 2 are 'in' and 'on'. Clark (1973) presents that the children already before that age appear to know that these words refer to spatial location. The results suggest that the way how the inflections for the internal and external locatives (prepositions or suffixes) are constructed does not alone explain their learning. It appears to be at least equally important that the children in different languages have first interiorized cognitions which activate the comprehension and the production of the forms indicating location.

When analysing the speech of American, Samoan, Luon and Finnish children, Bowerman (1973) makes the assumption that the development of syntax shows some universal constructions when considering the meaning, length and grammatical complexity of early utterances. It is more difficult to conclude about universals in morphological development than in syntactic structures. This is influenced by the fact that rules according to which inflections are formed, vary greatly in different languages. Thus the specific result from the mastery of inflections in some language cannot be directly generalized to other languages since the acquisition of morphemes is influenced besides by cognitive factors also by the linguistic complexity related to their production. This appears clearly e.g., in Egyptian Arabic where the complete forms of the plural are acquired later than in other languages because this plural is a very complex grammatical form in Arabic (Slobin 1973). The further specification of possible universals in learning of morphology would presuppose comparative cross-linguistic and cognitively oriented studies carried out systematically in different languages.

4.2.2. Stages in the correct acquisition of morphological forms

The results of studies 1 and 2 indicated that training increased the mastery of morphological forms in 3-, 4- and 5-year-old children. The changes caused by training appeared as a decrease in the quantity of

errors as well as a change in their quality. The error analyses of the children's responses (study 3) indicated that the correct production of morphological forms is achieved gradually through certain wrong responses (Lyytinen 1973). Similar observations have been presented among others by Cromer (1968) and Beilin (1975).

The transitional stages from erroneous responses to correct performances are as follows: At the first stage children who do not master the required from repeat the stimulus word in its basic form. This also appears at the early stage of spontaneous speech when a child produces word combinations in the basic form as the syntactic and morphological rules of utterances have not yet been interiorized. At the second stage the child according to analogy model applies some other inflection he has learned earlier to the required form, e.g., replaces the past tense with forms of the active indicative present, the passive with active forms, and the superlative with comparative forms. At the third stage the child masters the form in a limited group of words but when the grammatical characteristics of words (gradation, length of word etc.) vary, he makes specific errors related to stem inflection (changing, excluding, adding letters/syllables). The following forms belonging to this particular stage were found in the speech of 2-year-old children: 'ihanoita kukkeja' instead of ihania kukkia, 'kynejä' - kyniä, 'havetaan' - haetaan, 'irroin' - irroitin, respectively. Qualitatively these errors are 'better' than those at stages I and II, because they do not change the meaning of the utterance any more. At the fourth stage the child masters the forms of both ending and stem inflection and can apply them to grammatically and statistically different new words (Lyytinen 1973).

Training influenced the responses of 3-year-olds in the morphology tests so that the responses in the pretest were transmitted from the first stage to forms representing the second and third stages. Among 4- and 5-year-olds the second and third stage responses were transmitted in some of the morphological forms into performances of the fourth stage. It was further stated that the errors belonging to stages II and III among 3-year-olds were related to the cognitive test results. Significant positive correlations appeared between memory tasks and the mastery of vocabulary as well as between categories of suffix and

stem errors. The correlations between tasks measuring analogical reasoning and stem errors were also high among 3-year-olds. Similar connections were still observed in 4-year-olds. The errors belonging to stages II and III among 5-year-olds, who had already mastered most of the required inflections, correlated negatively with the results for memory and analogy tests.

The examination of the stage in which linguistic errors occur is important because it is a means of receiving information about the thinking and reasoning models with which a child attempts to solve linguistic problems. At the same time knowledge can be received about utterances which should be promoted by various training methods if a child's linguistic development has not proceeded according to the pattern normal to his age-group. In the future, experimentation should be expanded to include younger age-groups and to examine what the typical erroneous utterances appearing at the early stage of development are, as well as what their detailed relation to a child's cognitive level is.

4.2.3. Interpretation of the results from the cognitive viewpoint

Some results obtained from the present studies are worth a short theoretical evaluation. The facts that association value was not a significant explanatory factor in the acquisition of the model for morphological forms and that the clearest training effects appeared in different forms among different age-groups as well as the fact that the youngest age-group, because of not mastering the required cognitive skills, was unable to acquire the morphological forms stably (e.g., the superlative among 3-year-olds), support the interpretation that the approach to the acquisition of morphology can not be based on the learning theory only. Learning should be regarded as cognitive action so that the results to be achieved are closely related to the learner's contemporary cognitive level of development (Inhelder, Sinclair & Bovet 1974).

The close connection between language and the mastery of certain cognitions was also realized in the data of 2-year-olds (Lyytinen 1975). The grouping of 2-year-olds according to cognitive test scores indicated a significant statistical relationship between the highest and lowest levels. The subjects at the highest level performed better in the comprehension and production tests than the group at the lowest one. The level differences were clearer in the production than in the comprehension of morphological forms and extended as a function of age. Children who could only weakly observe and distinguish the critical characteristics of the presented tasks (breadth, length, similarity, quantity, biggest/smallest) acquired the morphological forms less satisfactorily than the children whose cognitive skills had developed better than the average.

The positive correlations between cognitive variables and specific suffix and stem errors among 3-year-olds (cf. pp.99-100) referred to a connection between the mastery of language and cognitions. If a child of this age had not mastered the cognitive skills presupposed by the morphological form, he produced inadequate responses and repetitions of words in their basic form. Cognitively skilled 3-year-olds also produced qualitatively 'good' suffix and stem errors, and the reponses were thus quite close to correct forms. The results of error analyses justify the conclusion that linguistic errors are part of language acquisition. Errors in language production arise as the result of remembering and reasoning processes typical to each age and thus reflect the connections with the child's cognitive level of development (Cromer 1968, Slobin 1973, Inhelder, Sinclair & Bovet 1974, Beilin 1975).

4.3. Application of the results to educational guidance

4.3.1. Training on group-level and for disadvantaged groups

Language teaching programmes were compared in the second study. It is commonly known that learning effects in young children are quite strongly associated with the method used in training. Consequently, in this study, morphological forms were trained with programmes all producing orientation but with different methods and contents. The toy programme was based on active play while the picture card one was, although interesting for children, more formal and presupposed a different kind of activity from the subjects than toys did. The third programme to be compared was a combination of the two. The results of this study indicated that all the training programmes (toys, picture cards, toys & picture cards) increased the mastery of morphological forms significantly and equally much on the average. The learning results were also stable for at least five months both in study 1 and study 2.

When evaluating the effectiveness of the training programmes it should be taken into account that the method of teaching was individual in all programmes. Although this teaching method has proved to be the most effective as regards learning results, other findings indicate that the level of mastering the morphological forms can also be increased by small-group teaching (Viitasaari 1975). Four-year-olds taught by picture cards in groups of four improved their performance significantly in that learning results were stable for at least six months. Group teaching has better chances of being carried out in early education-programmes than individual teaching. Consequently, a problem worth analysing in further studies is to what age such group teaching could be applied and what would be the best size for a group at different age-levels. So far only Kuusinen & Viitanen (1974) have published group teaching programmes developing the communicative skills of Finnish preschoolers. These programmes can also be carried out individually.

The subjects in the present studies were developmentally normal 2 to 5-year-old children. Thus the results cannot be generalized to situations in which the training is directed towards groups heterogenous

in age and developmental level (e.g., mentally-deficient or children with learning difficulties). Some training experiments on the mastery of inflections have been performed among mentally-deficient children and those with defective hearing. Bradbury & Lunzer (1972) taught English morphology using artificial words to groups of mentally-deficient and normal children matched in their intelligence age. The past tense, plural formation, and possessive forms were the items to be taught. The mentally-deficient children improved their performance to some degree as did normal children, but transfer of the acquired items remained minor. According to Mueller & Smith (1964) the effects of training among the mentally-deficient are short-lived. The learning results are not generalized and their stability remains weak. The weak generalization of the training results in retarded children was also noticed by Guess & Baer (1973) when studing the learning of the plural morpheme. The retarded children did not learn as the normal subjects did that the acquired items in the receptive mode could be generalized for production, too.

Strömnes (1974) has presented an experimental method for comparing the structural relations of Swedish prepositions and those of Finnish case endings. Later Strömnes has applied this knowledge to the planning of a method for teaching Finnish morphology to deaf children. The acquisition of the case endings is specially important for this group because the mastery of endings helps deaf children to understand the relationships between words and the concepts expressed by them.

Only the toy programme of the training programmes used in the present study has been applied to a group in which the development of children has not proceeded according to their chronological age. In spring 1974, a speech therapist taught morphological forms with the toy programme to six CP-children in a kindergarten. Each child was trained individually four times (20 mins per training on the average). The objects of training were the same forms as in study 2 (Lyytinen 1974). The programmes differed only in that both the measurements and training in the CP-group were performed with familiar colloquial words. The results revealed that the immediate and stable effects of training were clear also in the CP-group. The subjects' pretest and post-test II results differed significantly from each other (Lyytinen 1974, p. 27).

Children retarded in linguistic development should also be chosen as objects for training. It is obvious that the various types of training programmes used in the present studies would motivate this group of children and when performed systematically would promote the mastery of linguistic skills immediately as well as at the later stages of development. The discovery of an orientative teaching method and material for disadvantaged children presupposes that the earlier experiences and the history of learning in each child is examined. Special attention should then be paid to the maintenance of orientation since the programmes must be more extensive than those presently used.

4.3.2. Proposals for actions to promote the linguistic skills of children

Study 4 succeeded in discovering some variables describing a child's environment and his interaction with his mother which were related to his linguistic and cognitive skills. The following is an attempt to demonstrate the above-mentioned relations by examining the way in which linguistic guidance could proceed in early childhood.

Language acquisition takes place in interaction between the child and his social and physical environment. This presupposes the deliberate guidance of the child's activities. Adults should help the child to orient towards his environment and to perceive the features and special characteristics of the items in it. Generalized orientation has been verified as promoting the child's perceptive activities and learning in general (Lewis & Goldberg 1969, Lewis 1971).

Eight to twelve-month-old children learn to distinguish between actions and their objects. Thus a child observes that not only he himself but other people too can be agents and perform the same actions (Sinclair 1971, Sinclair-de Zwart 1974). According to Bruner (1975, 1977) a child interiorizes these concepts in joint activities with an adult. A child does not only learn the basic forms of action but also to replace some actions with others and to change their order. Important in mutual games is that play behaviour is combined with adults' verbal

description of events and the characteristics of things. Thus a child learns, besides the speech he had heard, to observe the situations where the speech occurs.

Between the age-range of 12-24 months children begin to produce meaningful speech related to action. The cognitive approach considers language acquisition to take place analogically with the integration of action patterns (Sinclair 1971, Bruner 1975, 1977; McCall 1976). According to Sinclair-de Zwart (1974) the mechanisms determining the co-ordination of actions during the first year also influence how a child later forms the syntactic structures of his mother tongue. Together with language acquisition, children begin to present their observations of the environment with the help of recollections and images in their play. Children's representational activities, imaginativeness and its many-sided expression should be rewarded in all possible ways. The importance of these skills in language acquisition are emphasized by results indicating that children retarded in linguistic development are also limited in the quantity and quality of representational activities (Morehead & Morehead 1974).

After the basic syntactic sentence structure (subject-predicate-object) has become established and the first morphological forms have occurred in the child's speech (singular/plural, the genitive, the internal locative cases) adults should guide the child at the age of 25-36 months to the correct use of the linguistic concepts then developing. The objects of playlike teaching could be characteristics describing the size and quality of things (big/small, cold/hot, hard/soft, long/short, etc.), similarity concepts, quantitative utterances (more/less) and words defining the place and location of things (in the front of, above, behind) (Lyytinen 1975, 1976). Guidance should simultaneously be directed to extending the child's vocabulary, to training comparative forms (the positive - the comparative), and to the use of the internal and external locative cases (Päivinen 1972, Lyytinen 1975).

When guiding a child, the adult should remember that the mastery of morphology is achieved gradually through certain erroneous responses (Lyytinen 1973). Changes in the erroneous responses as such mean progress and imply that the acquisition of the morphological form has begun. This becomes especially clear among 2- to 3-years-olds whose mother-tongue

inflections are still at the active stage of development.

Between the age-range of 37-60 months children are motivated to use various tenses in their utterances and temporal qualifiers connected to them. Adults should further teach children the comparison of adjectives, especially the mastery of superlative forms (Ruoppila & Liste 1967, Luukkonen & Ruoppila 1969, Päivinen 1972, Lyytinen 1974), because at this age children acquire the cognitive skills presupposed by them. Children should also be guided to the correct inflection of the personal suffixes (Ruoppila 1969) and to the use of the cases appearing seldom in Finnish (Himberg 1967, Päivinen 1972, Ruoppila 1972).

At the average age of five years a child has acquired almost all of these Finnish inflections (Himberg 1967, Ruoppila & Liste 1967, Malin & Ruoppila 1969, Ruoppila 1969, 1972; Päivinen 1972, Lyytinen 1973, 1974). The linguistic control of behaviour has also developed to the stage where the meaning of speech begins to guide children's behaviour (Luria 1961). At the same time the function of speech changes while external speech broadens and moves to internal use.

By generalizing the results of study 4 some features of favourable environment for language learning can finally be described. It is important that adults, besides cognitive (descriptive, comparative, explanatory) communication, guide the child into uttering his thoughts and feelings verbally. The child regards these utterances as natural if the adults in the child's environment make use of them. If the child answers or does something incorrectly, adults should not ignore the error but give the child further hints with the aid of which he can reach the right solution. By explaining their own behaviour in everyday situations to the child, adults can guide the child to observe relationships between various activities and their consequences. It is also important that adults participate in and guide the child's play. The more versatile the child's play activities, images, and the experiences related to them are, the better are his opportunities of describing similar items later verbally. Adults ought to adapt their behaviour flexibly so that the child's orientation towards and interest in the tasks are taken into account during all kinds of adult-child interactional behaviour.

Guidance can only be purposeful when the adult has sufficient know-

ledge of the stages of child development and of the actions which should be directed towards the child at various ages. The results of an experiment with the mothers of 3-year-olds (Lyytinen 1976, pp. 80-81) revealed that parents should be given more basic information on how and to what kinds of play children of different ages should be guided. Furthermore, the results indicated that parents would also need, besides information on child development, concrete task material to be handled at home with the child. Tasks performed with the child helped the adults to organize the information presented in a new way, raised questions, and activated the adults to discuss them.

5. SUMMARY

The present studies were designed to map the mastery and learning of Finnish morphological forms and to find factors connected with their learning among 2- to 5-year-old children. The theoretical approach motivating the present empirical work moved from learning concepts to the direction of the cognitive approach represented by Slobin, Sinclair and others.

Study 1 (Päivinen 1972) examined the effects of training on the mastery of morphology in 3- to 5-year-old children. It was assumed that the clearest influences would appear in different morphological forms among children of different ages. The learning results were further hypothesized to have a connection with the amount of training given and to the association value of the stimulus words used in teaching. The effects of training were also expected to be generalized from the production of the morphological forms to their comprehension.

Study 2 (Lyytinen 1974) compared the influences of training programmes differing in their orientative aspects on the learning of morphological forms among 4-year-old children. With various control groups questions left unanswered and open to criticism in earlier learning experiments were analysed in greater detail. Questions controlled by these groups were: to what extent the achieved results are consequences of getting acquainted with the material and the tests without controlled training, participating in the repeated measurements only and developmental changes in linguistic skills associated with the eight months between measurements.

Study 3 (Lyytinen 1973) examined the qualitative and quantitative changes in the linguistic errors of 3- to 5-year-old children as a function of training and age. The connections between the linguistic

errors and some variables describing the children's cognitive level of development were also analysed.

Study 4 (Lyytinen 1975, 1976) considered the problem of the relationships between the mother's methods of guidance, communication models, ways of reinforcement, the flexibility of interaction, the opportunities for action, and learning offered by the environment, and the linguistic and cognitive skills of 2-year-old children.

One hundred and forty (140) 2- to 5-year-old children participated in the studies. The subjects were girls and boys from skilled working- and middle-class families. All the children were from the kindergartens and children's clubs in the city of Jyväskylä.

Picture card tests constructed for these studies by applying Berko's (1958) method were used for measuring the production and the comprehension of the morphological forms. The tests included tasks mapping the mastery of Finnish morphology - inflections of adjectives, verbs and nouns. The stimulus words in the tests were archaic words. The number of syllables (2 or 3) in adjectives and nouns and the amount of syllables and the inflectional form (singular-plural) of verbs were varied in the stimulus words. The use of archaic words was an attempt to make sure that a child could not perform the tasks simply by using forms he had heard before. Effects of task repetition (pre- and post-tests) were eliminated by exchanging one third of the post-test items for new ones.

Results from the teaching experiments indicated that a comparatively short-term training increased the mastery of morphological forms among 3- to 5-year-old children so that the learning results were stable for at least five months. Some age-specific effects of training were revealed. In 3-year-olds the clearest learning effects were found in forms of the inessive, the active indicative present, and the comparative, while the clearest effects of training among 4- and 5-year-olds were in the superlative, the passive indicative present, and the adverb.

The amount of training needed for the complete learning of a morphological form was related to the subjects' ages. 3-year-olds and in most cases 4-year-olds too needed five trainings, whereas 5-year-olds achieved similar results after three trainings. The results also indicated that the effects of training were not only focused on certain

words but that all age-groups could apply the acquired forms to new stems.

The assumption based on the theory of learning about the influences of association value on learning results received no direct support. The association value of the stimulus words did not explain in any age-group the variance in the acquisition of the model score. It had, however, a significant connection with the mastery of the correctness of the morphological forms. The observed association increased with age and was clearest among 5-year-olds. The result indicates that, more than the other age-groups, 5-year-olds had, on the basis of what they had learned earlier, familiar associations of words with high association values, which facilitate the handling of the words, remembering and recalling them in a grammatically correct form. Familiar associations of some words were also probably the cause why 5-year-olds attempted to change the stimulus words differing from present-day language into words corresponding to colloquial forms more actively than the younger age-groups.

In the comprehension test, 4- and 5-year-olds achieved maximum scores in the passive indicative present, the perfect, the comitative and the abessive. Thus transfer from one type of test performance to another could not be reliably estimated in those age-groups. An estimation of the lower and top limits for the performances is problematic when constructing tests for age-groups differing in their linguistic skills as much as 3- and 5-year-olds do. It is obvious that the oldest subjects in this study had acquired some of the inflections in the comprehension test so well that increasing the number of items or making them more difficult would not have changed the results. Within the above limits it is, however, possible to draw the preliminary conclusion that the production of morphological forms transfers to comprehension performance in all age-groups studied.

The comparison of the training programmes showed that all the programmes differing in their orientative aspects (toys, picture cards, toys & picture cards) increased the mastery of morphological forms significantly and equally much on the average. The results achieved with the toy programme also revealed that the children had not only learned to respond in the way required by the measurement, but that

they could apply what they had learned to new stimulus material in a new situation. If it had only been a question of 'set-learning', the group trained with picture cards should have performed significantly better than the other groups, because in that group both the measurements and training had been performed with similar material.

The comparison of the learning results between the experimental and control groups revealed that also the non-trained groups improved their performance from one measurement to another. The changes in the learning results of the control groups were, however, minor compared to those caused by systematic training. Thus participation in the measurements, getting acquainted with the materials, and developmental changes during the five months as such were not sufficient to increase the mastery of morphological forms to the level of the trained experimental groups.

The analysis of the training results of the separate morphological forms indicated that significant differences existed only in the mastery of two morphological forms, the adverb and the passive indicative present. The learning results of the adverb were not as stable in the group trained with toys as in the other experimental groups. This result may be influenced by the fact that the demonstration of the activity connected with adverb formation succeeded better in the picture card programme than in the toy programme. The same reason may influence the result according to which the learning results of the group trained by picture cards in the model variable of the passive indicative present were not as stable as in the toy programme, in which this form was taught with the help of the children's own activities. Concrete demonstration of the actional components included in the items to be trained appeared to be a central factor influencing the children's learning results.

The starting point for the examination of children's linguistic errors was the thought that erroneous utterances at the early stage of development are not random but that they appear as the result of the reasoning and thinking processes typical to each age-level. The analysis of the errors was also motivated by the knowledge that Finnish, with its special characteristics, makes possible a more versatile and wider description of the children's errors than the Indo-

European languages.

The results of the error analyses indicated that the correct inflections are achieved stage by stage. Inadequate responses decreased through training in all age-groups and the errors were transmitted to the spesific subcategories of suffix and stem errors which are closer to correct responses. The clearest changes in errors were found in 3-year-olds. In this age-group, the positive correlations between the error and cognitive variables were clearer than in the other age-groups. Three-year-olds who had performed well in the cognitive tests made more suffix and stem errors than the other groups. However, they also made fewer inadequate responses than 3-year-olds with lower cognitive scores. Similar connections were found among 4-year-olds. In 5-year-olds the correlations between errors and cognitive variables were in most cases negative. At this age, the cognitive performance exceeds the level necessary for mastering basic forms of the Finnish morphology.

When interpreting linguistic errors the age and the children's cognitive level of development must always be taken into account, as the same error means different things at different age-levels. The occurrence of certain errors (e.g., stem errors) among younger subjects often implies that their linguistic skills have developed better than the average, while similar errors among a couple of years older children indicate performance weaker than that of their age-level. The linguistic errors tell us just as much as correct performances about the linguistic processing capacity of children and how to plan teaching material suitable to that capacity.

The first studies revealed quite extensive interindividual differences in linguistic skills within the age-levels. The last study approached the problem related to one of the causes of those differences, viz. that of the relationship between children's environment and linguistic-cognitive skills. The results indicated clearly the significance of some environmental variables in early childhood. Significant in the interaction were the mother's linguistic code, explanations supporting the child's correct performances, reinforcing comments, the flexibility of interaction and the mother's eye-contacts with the child. Stronger than the other environmental variables were the mother's daily use of time with the child, explaining behaviour to the child in every-

day problematic situations, and the quality of the child's play material. These variables combined together predicted better than single correlations the variance of linguistic-cognitive skills. The variables were also observed to correlate with the children's attentiveness, co-operativeness, and with the amount of their communication during the tasks presented in interaction. Further, the prediction value of the variables was found to be stable for at least eight months.

The above-described environmental variables explained 30-40% of the variance in 2-year-olds' linguistic-cognitive scores. Although common variance was relatively small, it proved, however, reliable on the basis of the remeasurement. Thus it may be justifiable to conclude that the presently analysed mother interaction can be generalized to cover her typical way of communication with the child in a new situation.

When planning guidance suitable for children of different ages, it must be remembered that language acquisition does not occur separately form a child's other development. Taking the global character of development into account means that the guidance of linguistic skills should be a natural part of adult-child daily behaviour aiming at the expansion and the versatile expression of a child's activities, thought and images besides increasing mastery of language. The influences of early begun and logically conducted guidance will later be seen in that a child can express himself fluently and use language for acquiring knowledge and for the verbal communication of his own thoughts and experiences. Thus the mastery of mother tongue is, since already the early stage of development, an essential basis for human learning and active interaction.

TIIVISTELMÄ: SUOMEN KIELEN MORFOLOGISTEN SÄÄNNÖNMUKAISUUKSIEN OMAKSUMINEN VARHAISLAPSUUDESSA

Tutkimuksen tavoitteena oli kartoittaa suomen kielen morfologisten säännönmukaisuuksien hallintaa ja oppimista sekä etsiä oppimiseen yhteydessä olevia tekijöitä 2-5 -vuotiailla lapsilla. Empiiristä työtä aluksi ohjanneet oppimisteoreettiset käsitteet ovat saatujen tutkimustulosten myötä muuttuneet kognitiiviseen suuntaan tavalla, jota kielen oppimisessa edustavat mm. Slobin ja Sinclair.

Kokeessa 1 (Päivinen 1972) tarkasteltiin harjoituksen vaikutuksia säännönmukaisuuksien hallintaan 3-5 -vuotiailla lapsilla. Tutkimuksessa oletettiin, että selvimmät harjoitusvaikutukset tulisivat esille eri-ikäisillä lapsilla eri säännönmukaisuuksissa. Edelleen oppimistulosten otaksuttiin olevan yhteydessä annetun harjoituksen määrään sekä opetuksessa käytettyjen ärsykesanojen assosiaatioarvoon. Harjoitusvaikutusten oletettiin myös yleistyvän säännönmukaisuuksien tuottamisesta niiden ymmärtämiseen.

Kokeessa 2 (Lyytinen 1974) verrattiin orientoivilla ominaisuuksiltaan erilaisten harjoitusohjelmien vaikutuksia säännönmukaisuuksien oppimiseen 4-vuotiailla lapsilla. Samalla erilaisia kontrolliryhmiä käyttäen tarkennettiin aikaisemmissa oppimiskokeissa avoimiksi jääneitä kysymyksiä siitä, missä määrin oppimistulokset olivat seurausta harjoitusmateriaaleihin tutustumisesta ilman ohjattua harjoitusta, toistuvien mittauskertojen aiheuttamista tottumisefekteistä ja mittauskertojen välillä tapahtuneista kehitysmuutoksista.

Kokeessa 3 (Lyytinen 1973) selvitettiin 3-5 -vuotiaiden lasten kielivirheissä harjoituksen ja iän funktiona esiintyneitä laadullisia ja määrällisiä muutoksia sekä tarkasteltiin kielivirheiden ja eräiden lasten kognitiivista kehitystasoa kuvaavien muuttujien yhteyksiä.

Kokeessa 4 (Lyytinen 1975, 1976) analysoitiin äidin ohjantamenettelyiden, kommunikointimallien, vahvistamistapojen, vuorovaikutuskäyttäytymisen joustavuuden sekä kasvuympäristön tarjoamien toiminta- ja oppimismahdollisuuksien yhteyksiä 2-vuotiaiden lasten kielellisiin ja kognitiivisiin taitoihin.

Tutkimuksiin osallistui 140 2-5 -vuotiasta lasta. Mukana oli sekä tyttöjä että poikia ammattitaitoista työväestöä ja keskiluokkaa edustavista perheistä. Tutkimushetkellä kaikki lapset kävivät Jyväskylän kaupungin päiväkodeissa tai -kerhoissa.

Taivutussääntöjen mittausmenetelminä käytettiin kuvakorttitestejä, jotka oli Berkon (1958) menetelmää soveltaen laadittu näitä tutkimuksia varten. Morfologiatesteillä mitattiin suomen kielen säännönmukaisuuksista adjektiivien taivuttamisen sekä aika- ja sijamuotojen hallintaa. Ärsykesanoina testeissä käytettiin vanhoja suomen kielen sanoja, joita ei enää esiinny nykykielessä. Sanoista varioitiin adjektiivien ja substantiivien tavulukua (2-3 -tavuiset) sekä verbien tavulukua ja taivutusmuotoa (yksikkö-monikko). Käyttämällä lapsille vieraita sanoja testiosioissa haluttiin kontrolloida sitä, että tehtävistä ei voinut suoriutua pelkästään puhekielen malleja jäljittelemällä. Tehtävien toiston (alku- ja loppumittaustestit) vaikutuksia pyrittiin vähentämään sillä, että loppumittaustestien osioista ja niissä käytetyistä ärsykesanoista kolmasosa oli kummallakin mittauskerralla lapsille uusia.

Opettamiskokeiden tulokset osoittivat, että verraten lyhytaikaisella harjoituksella onnistuttiin lisäämään 3-5 -vuotiaiden lasten morfologisten säännönmukaisuuksien hallintaa siten, että oppimistulokset olivat vähintään viiden kuukauden ajan pysyvät. Harjoituksen spesifit vaikutukset tulivat eri ikätasoilla esille siten, että 3-vuotiaat oppivat eniten inessiivi-, aktiivin indikatiivin preesens- ja komparatiivimuotoja, kun taas 4- ja 5-vuotiailla selvimmät harjoitusvaikutukset todettiin superlatiivissa, passiivin indikatiivin preesensissä ja adverbissa.

Taivutusmuotojen oppimiseen tarvittavan harjoituksen määrä oli yhteydessä koehenkilöiden ikään: 3-vuotiaat ja useimmissa tapauksissa myös 4-vuotiaat tarvitsivat viisi harjoituskertaa 5-vuotiaiden saavuttaessa vastaavia tuloksia jo kolmella harjoituskerralla. Tulokset

osoittivat myös, että harjoituksen vaikutukset eivät kohdistuneet vain tiettyihin sanoihin, vaan opittuja päätteitä osattiin soveltaa myös uusiin sanavartaloihin kaikissa ikäryhmissä.

Oppimisteoriaan pohjaava oletus assosiaatioarvon vaikutuksista oppimistuloksiin ei saanut suoranaisesti tukea. Ärsykesanojen assosiaatioarvo ei selittänyt missään ikäryhmässä taivutusmuotojen mallin oppimisen varianssia, mutta oli merkitsevästi yhteydessä säännönmukaisuuksien tarkkuuden hallintaan. Havaittu yhteys lisääntyi iän myötä ja oli voimakkain 5-vuotiailla. Tulos viittaa siihen, että 5-vuotiailla liittyi aiemmin opitun perusteella muita ikäryhmiä enemmän assosiaatioarvoltaan korkeisiin sanoihin tuttuuden vaikutelmia, jotka helpottivat sanojen mieleen painamista, niiden muistista palauttamista ja kieliopillisesti oikeassa muodossa taivuttamista. Tuttuuden vaikutelmat joissakin sanoissa saivat aikaan myös sen, että 5-vuotiaat pyrkivät muita ikäryhmiä aktiivisemmin muuntamaan nykykielestä poikkeavia ärsykesanoja puhekielen muotoja vastaaviksi.

Ymmärtämistestissä 4- ja 5-vuotiaat saavuttivat maksimipistemääriä passiivin preesensissä, perfektissä, komitatiivissa ja abessiivissa. Vanhemmilla ikäryhmillä ei näin ollen pystytty luotettavasti arvioimaan siirtovaikutuksia testityypistä toiseen. Suoritusten ala- ja ylärajan arviointi on pulmallista laadittaessa testejä, jotka kohdistuvat kielellisiltä taidoiltaan eritasoisiin ryhmiin. Ilmeisesti vanhimmat koehenkilöt olivat omaksuneet osan ymmärtämistestin taivutussäännöistä jo niin hyvin, että osioiden lisääminen ja niiden vaikeuttaminen ei olisi aiheuttanut muutoksia saatuihin tuloksiin.

Selvitettäessä erityyppisten harjoitusohjelmien vaikutuksia oppimistuloksiin todettiin, että kaikki orientoivilta ominaisuuksiltaan erilaiset ohjelmat (leikkikalut, kuvakortit, leikkikalut & kuvakortit) lisäsivät säännönmukaisuuksien hallintaa keskimäärin yhtä paljon. Tulokset osoittivat, että harjoituksen avulla ei ollut opittu reagoimaan vain mittaustilanteen edellyttämällä tavalla, vaan opittuja asioita osattiin soveltaa kokonaan uuteen ärsykemateriaaliin uudessa tilanteessa. Jos kyseessä olisi ollut pelkkä 'test-set' oppiminen kuvakorteilla harjoitusta saaneen ryhmän olisi pitänyt suoriutua muita ryhmiä paremmin, koska sillä sekä mittaukset että harjoittaminen oli suoritettu samankaltaisella materiaalilla. Koe- ja kontrolliryhmien

oppimistulosten vertailu osoitti, että myös ei-ohjattua harjoitusta saaneet ryhmät paransivat tuloksiaan mittauskerrasta toiseen. Huomattavaa kuitenkin on, että testauksiin osallistumisen, harjoitusmateriaaleihin tutustumisen ja viiden kuukauden aikana kielellisissä taidoissa tapahtuneen kehityksen vaikutukset oppimistuloksissa olivat systemaattisesti toteutetun harjoittamisen aiheuttamia muutoksia vähäisemmät.

Tarkasteltaessa säännönmukaisuuksittain erityyppisten harjoitusohjelmien tuottamia oppimistuloksia havaittiin ryhmien välisiä merkitseviä eroja ainoastaan kahden taivutusmuodon - adverbin ja passiivin indikatiivin preesensin - hallinnassa. Adverbin oppimistulokset eivät olleet leikkikaluilla harjoitusta saaneella ryhmällä yhtä pysyviä kuin muilla ryhmillä. Tulokseen osittain vaikuttanee se, että kuvakorttiohjelmassa pystyttiin leikkikaluohjelmaa paremmin havainnollistamaan adverbin muodostamiseen liittyvä toiminta. Samasta syystä aiheutunee tulos, jonka mukaan kuvakorteilla harjoitusta saaneen ryhmän oppimistulokset passiivin indikatiivin preesensissä eivät olleet yhtä pysyviä kuin leikkikaluohjelmassa, jossa tätä säännönmukaisuutta opetettiin lasten omien toimintojen avulla. Tulokset osoittivat, että harjoitettaviin asioihin sisältyvien toimintojen havainnollistamisella on keskeinen merkitys lasten oppimisessa.

Lasten kielivirheiden tarkastelussa lähtökohtana oli ajatus siitä, että kehityksen varhaisvaiheessa esiintyvät virheelliset ilmaisut eivät ole sattumanvaraisia, vaan ne syntyvät kullekin ikäkaudelle ominaisten ajattelu- ja päättelytaitojen tuloksena. Virheiden tarkastelua motivoi myös tieto siitä, että suomen kieli erityispiirteineen mahdollistaa indoeurooppalaisia kieliä monipuolisemman virheiden kuvauksen lapsilla.

Virheanalyysien tulokset osoittivat, että säännönmukaisuuksien hallintaan edetään vaiheittain. Harjoituksen vaikutuksesta epäadekvaatit vastaukset vähenivät kaikilla ikäryhmillä ja virheet siirtyivät lähempänä oikeita vastauksia oleviin pääte- ja vartalovirheluokkiin. Virhevastauksissa tapahtuneet muutokset olivat selvimmät 3-vuotiailla. Sitä vastoin 4- ja 5-vuotiailla koe- ja kontrolliryhmien väliset erot eri virhekategorioissa eivät olleet enää yhtä selvät kuin 3-vuotiailla.

Kolmivuotiaiden ikäryhmässä todettiin myös muita selvemmin virheva-

riaabelien ja kognitiivisten muuttujien positiiviset riippuvuussuhteet. Kognitiivisista tehtävistä hyvin suoriutuneilla 3-vuotiailla esiintyi muita vähemmän epäadekvaatteja vastauksia ja vastaavasti he tekivät muita enemmän spesifejä pääte- ja vartalovirheitä. Samansuuntaisia yhteyksiä havaittiin vielä 4-vuotiailla. Sitä vastoin 5-vuotiailla pääte- ja vartalovirheiden ja kognitiivisten muuttujien väliset yhteydet olivat useammissa tapauksissa negatiiviset. Tämä osoittaa, että 5-vuotias lapsi on saavuttanut jo säännönmukaisuuksien hallinnassa tason, jossa aikaisempien ikävaiheiden hyvät, lähellä oikeita vastauksia olevat pääte- ja vartalovirheet ovat muuttuneet oikeiksi suorituksiksi.

Kielivirheitä tulkittaessa on syytä ottaa huomioon tutkittavan lapsiryhmän ikä ja kognitiivinen kehitystaso, koska sama virhe merkitsee eri asioita eri ikätasoilla. Tiettyjen virheiden esiintyminen (esimerkiksi sanavartaloiden taivutusvirheet) nuoremmilla koehenkilöillä voi viitata keskimääräistä paremmin kehittyneisiin kielellisiin taitoihin vastaavien virheiden osoittaessa paria vuotta myöhemmin ikätasoa heikompaa suoritusta. Kielivirheiden analysointi täydentää olennaisella tavalla kuvaa lapsen kielitaidosta ja antaa tietoa niistä sisällöistä, joita erilaisin ohjantamenetelmin tulisi pyrkiä edistämään silloin, kun lapsen kielellinen kehitys ei ole edennyt oman ikäryhmän suoritusta vastaavalla tavalla.

Tutkimusten tulokset osoittivat lasten kielellisissä taidoissa esiintyvän ikäryhmän sisällä huomattavia yksilöiden välisiä eroja. Näitä eroja aiheuttavia tekijöitä pyrittiin selvittämään tämän työn viimeisessä kokeessa, jossa tarkasteltiin kasvuympäristöjen ja kaksivuotiaiden lasten kielellisten ja kognitiivisten taitojen välisiä yhteyksiä. Tulosten mukaan eräät kasvuympäristömuuttujat näyttivät olevan yhteydessä lasten suoriutumiseen kielellisistä ja kognitiivisista tehtävistä jo kehityksen varhaisvaiheessa. Vuorovaikutusmuuttujista merkitseviksi osoittautuivat äidin kielellisten ilmaisujen koodi, oikeita suorituksia edesauttavat selitykset, vahvistavat toteamukset, vuorovaikutuskäyttäytymisen joustavuus ja äidin lapseen kohdistamat katsekontaktit. Kasvuympäristömuuttujista muita voimakkaammin esille tulivat äidin päivittäinen ajankäyttö lapsen kanssa, käyttäytymisen selittäminen lapselle jokapäiväisissä pulmatilanteissa sekä lapsen

käytössä olevan leikkimateriaalin laatu. Keskenään yhdistyneinä nämä muuttujat ennustivat yksittäisiä korrelaatiokertoimia paremmin lasten kielellisten ja kognitiivisten taitojen hallinnan varianssia. Muuttujien havaittiin olevan yhteydessä myös lasten tarkkaavaisuuteen, yhteistoiminnallisuuteen sekä kommunikoinnin runsauteen vuorovaikutustilanteessa esitettyjen tehtävien aikana. Edelleen muuttujien ennusarvo todettiin vähintään kahdeksan kuukauden ajan pysyväksi.

Edellä esitetyt kasvuympäristömuuttujat selittivät kaksivuotiaiden lasten kielellis-kognitiivisten testitulosten varianssista keskimäärin 30-40%. Vaikka yhteinen varianssi oli verraten pieni, se osoittautui kuitenkin uusintamittauksen perusteella reliaabeliksi. Lienee oikeutettua päätellä, että nyt analysoitu äidin vuorovaikutuskäyttäytyminen edustaa yleisemminkin hänelle tyypillistä tapaa kommunikoida lapsensa kanssa uudessa tilanteessa.

Eri-ikäisille lapsille soveltuvaa ohjausta suunniteltaessa on muistettava, että kielen oppiminen ei tapahdu erillisenä lapsen muusta kehityksestä. Kehityksen kokonaisvaltaisuuden tähdentäminen merkitsee sitä, että kielellisten taitojen ohjaamisen tulisi olla luonnollinen osa aikuisen ja lapsen päivittäisestä käyttäytymisestä, jossa pyritään kielen hallinnan edistämisen ohella lapsen toimintojen, ajattelun ja mielikuvien laajentamiseen ja monipuoliseen ilmentämiseen. Varhain alkaneen ja johdonmukaisesti edenneen ohjannan vaikutukset näkyvät myöhemmin siinä, että lapsi pystyy ilmaisemaan sujuvasti itseään sekä käyttämään kieltä tiedonhankintaan ja omien ajatustensa ja kokemustensa kielelliseen viestintään. Näin äidinkielen hallinta on jo kehityksen varhaisvaiheesta lähtien inhimillisen oppimisen ja aktiivin vuorovaikutuksen olennainen perusta.

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APPENDICES

Appendix 1. On Finnish morphology

Finnish belongs to the Finno-Ugric languages. Finnish words have no articles or gender. The first syllable of a word has the main stress, pitch usually follows stress. The pitch of the last syllable in a word is usually lower than that of the first syllable. Free word-order, gradation in the stem, several cases, and verb-inflection in various persons are typical characteristics of the Finnish language. A short review of the Finnish morphology is presented below. The description is not complete; only the rules appearing in the present study are examined closely.

Gradation

Gradation is applied to medial consonants k, p and t as well as double consonants kk, pp and tt. Gradation distinguishes between strong and weak grade; some forms have strong grade, others have weak grade.

Strong grade		Weak grade		
takki	(coat, nominative)	takin	(genitive)	kk ~ k
nappi	(button ")	napin	"	pp ~ p
hattu	(hat ")	hatun	"	tt ~ t
sanko	(pail ")	sangon	"	nk ~ ng (ŋk ~ ŋŋ)
puku	(dress ")	puvun	"	uku, yky ~ uvu, yvy
jälki	(trace ")	jäljen	"	lk ~ lj
särki	(roach ")	särjen	"	rk ~ rj
sika	(pig ")	sian	"	k ~ loss
tapa	(custom ")	tavan	"	p ~ v
kampa	(comb ")	kamman	"	mp ~ mm
äiti	(mother ")	äidin	"	t ~ d
kehto	(cradle ")	kehdon	"	ht ~ hd
valta	(power ")	vallan	"	lt ~ ll
ranta	(shore ")	rannan	"	nt ~ nn
parta	(beard ")	parran	"	rt ~ rr

Appendix 1. (continued)

Medial k, p and t are not, however, always subjected to gradation. E.g., the combination hk can remain unchanged as vihko ~ vihkon, sähkö ~ sähkön. The combinations tk, sk, st and sp remain ungraded. The same applies to many new loan words, e.g. auto ~ auton, muki ~ mukin.

Verbs

Finnish verbs are conjugated in various persons. The personal form is defined by the agent of the event. There are three singular and three plural personal forms. The ending of the 1st person singular is n, the 2nd person singular t, the 1st person plural mme, the 2nd person plural tte and the 3rd person plural vat, vät respectively. The 3rd person singular either has no ending at all, or has the final vowel doubled.

The inflection of Finnish verbs has two main categories, the active and the passive. Passive forms have no subject. The Finnish moods are the indicative, the potential, the conditional, and the imperative. Indicative forms appear in the present tense, the past tense, the perfect tense, and the pluperfect tense.

In the active indicative present the personal endings are attached to the end of the stem. The present tense can - depending on the context - express either the present or the future. The verb 'laulaa' (to sing) is conjugated here in the various personal forms of the active indicative present and past.

Active indicative present		Active indicative past	
sg 1st	laulan	sg 1st	lauloin
2nd	laulat	2nd	lauloit
3rd	laulaa	3rd	lauloi
pl 1st	laulamme	pl 1st	lauloimme
2nd	laulatte	2nd	lauloitte
3rd	laulavat	3rd	lauloivat

Appendix 1. (continued)

The last syllable of the passive indicative present is taan, tään, daan or dään. The last syllable of the passive indicative past is ttiin or tiin.

Passive indicative present	Passive indicative past
Täällä lauletaan.	Eilen täällä laulettiin.
(There is singing going on here)	(There was singing there yesterday)

The present form of the verb 'olla' (to be) is auxiliary in the perfect tense and the past form of the verb in the pluperfect. The auxiliary is conjugated in congruence with the subject. The main verb ends in -nut, -nyt or -nee. Both the allied forms express completed action.

The perfect	The pluperfect
Minä olen laulanut	He olivat jo laulaneet
(I have sung)	(They had already sung)

Cases

There are 15 cases in Finnish.

Case		Ending	Example
Nominative	who, what (sg+pl)	sg no ending pl t	kirja (book)
Essive	like what, as what	-na, -nä	kirjana
Translative	e.g., became something	-ksi	kirjaksi
Partitive	some of	-a	kirjaa
Genetive	whose, of what (sg+pl)	sg -n pl -en, -in, -ten -den, -tten	kirjan
Accusative	who, what	sg always similar to nominative or genetive pl always similar to nominative	kirja kirjan

Appendix 1. (continued)

Case		Ending	Example
Inessive	where, in what	-ssa, -ssä	kirjassa
Elative	where from, from what	-sta, -stä	kirjasta
Illative	where to, to what	vowel lenghtened+ -n or -n-n[x)] or sg -seen and pl -siin	kirjaan
Adessive	where, at what with what, with whom	-lla, -llä	kirjalla
Ablative	where from, from what, who from	-lta, -ltä	kirjalta
Allative	where to, to what to who(m)	-lle	kirjalle
Abessive	what without	-tta, -ttä	kirjatta
Comitative	what or who with	-ne (always pl)	kirjoinensa
Instructive	by what means, how	-n (often pl, meaning sg)	(kirjan)

Adjectives

Adjective attributes preceed and are congruent with the noun.

suuressa koulussa	(in a big school)
suurelta koululta	(from a big school)
suuren koulun etc.	(of a big school)

The comparison forms of the adjectives are the positive, the comparative and the superlative. The comparative has the marker -mpi in the singular nominative. Words, such as paljon (much), vielä (still), aina (always) yhä (e.g., 'ever bigger', nowadays 'bigger and bigger') are often used with the comparative.

The superlative has the marker -in in the singular nominative. Words, such as kaikkein, kaikista (of all) and mitä (e.g., most beautiful) are used with the superlative.

x)vowel between h-n is the same as the vowel preceeding h

Appendix 1. (continued)

Positive	Comparative	Superlative
suuri (big)	suurempi (bigger)	suurin (biggest)
kaunis (beautiful)	kauniimpi (more beautiful)	kaunein (most beautiful)

Adverbs

Adverbs of manner are formed by adding the suffix -sti to the stem of the adjective e.g., raju - rajusti, kaunis - kauniisti.

Table 1. Correlations of the cognitive and error variables among 3-year-olds in the pretest

Cognitive variables	Error variables											
	Inadequate response	Partly correct suffix	Suffix of another morphological form	Stimulus word repeated without suffix	Error in personal suffix	Dialectal inflection	Stimulus word changed into colloquial one	Stimulus word changed into another artificial word	Letter and/or syllable added to stem	Letter and/or syllable left out from stem	Syllable/letter in stem changed into another	Both suffix and stem error
picture vocabulary test	-54	-02	40	26	46	58	-08	-11	27	14	20	25
KTK	-11	-07	18	-02	14	-04	03	11	07	-08	11	29
number memory	-41	-14	25	26	05	08	-14	16	48	23	17	16
sentence memory	-30	-08	28	14	11	15	29	-00	23	20	09	12
letter memory	-12	-13	33	-03	13	12	-17	-18	-05	-19	01	23
word memory	-37	-18	30	32	16	38	13	-24	21	-06	03	17
visual memory	-45	04	51	-03	05	23	24	34	18	33	35	48
task memory	-44	24	17	29	44	33	-25	36	43	46	42	-06
verbal analogies	-34	-18	14	15	13	00	07	46	34	51	21	-07
block analogies	-43	-02	43	-08	03	-05	21	67	38	54	27	31
picture seriation	-19	-37	29	14	-12	15	21	07	05	-13	-16	32
Raven	-50	05	56	00	24	22	44	24	18	-02	14	74
concept formation	-26	07	25	-07	02	02	-07	38	27	40	23	35
picture ordering	-21	03	03	-02	13	22	17	34	17	26	22	09

$r \geq .34$, $p < .05$
$r \geq .45$, $p < .01$

Appendix 2. (continued)

Table 2. Correlations of the cognitive and error variables among 4-year-olds in the pretest

Cognitive variables	Error variables											
	Inadequate response	Partly correct suffix	Suffix of another morphological form	Stimulus word repeated without suffix	Error in personal suffix	Dialectal inflection	Stimulus word changed into colloquial one	Stimulus word changed into another artificial word	Letter and/or syllable added to stem	Letter and/or syllable left out from stem	Syllable/letter in stem changed into another	Both suffix and stem error
picture vocabulary test	-36	07	19	-27	34	-21	-45	16	31	13	23	32
KTK	-13	-09	-02	-25	20	-02	-13	-06	-06	-04	11	-09
number memory	-47	29	48	-26	57	01	-27	-23	07	07	13	11
sentence memory	-77	21	32	-42	65	05	-43	16	40	38	47	22
letter memory	-44	30	55	-17	53	19	-19	-18	02	03	-05	00
word memory	-20	15	22	-34	56	-24	-12	-23	-05	04	-01	05
visual memory	-56	44	28	08	48	21	-17	04	28	06	24	32
task memory	-65	01	18	-18	37	23	-35	31	50	28	32	25
verbal analogies	-33	-30	15	-20	13	00	-09	01	17	40	25	-10
block analogies	-32	04	-09	-29	21	02	-05	-06	38	41	33	36
picture seriation	-67	02	40	-28	25	03	04	08	28	38	19	37
Raven	-20	-04	00	-02	49	20	-46	-05	17	-11	-02	37
concept formation	-06	07	-10	-37	28	12	-33	-13	-01	18	13	-15
picture ordering	-19	07	09	-35	01	-24	-17	21	31	18	21	28

$r \geq .31$, $p < .05$
$r \geq .45$, $p < .01$

Table 3. Correlations of the cognitive and error variables among 5-year-olds in the pretest

Cognitive variables	Error variables											
	Inadequate response	Partly correct suffix	Suffix of another morphological form	Stimulus word repeated without suffix	Error in personal suffix	Dialectal inflection	Stimulus word changed into colloquial one	Stimulus word changed into another artificial word	Letter and/or syllable added to stem	Letter and/or syllable left out from stem	Syllable/letter in stem changed into another	Both suffix and stem error
picture vocabulary test	-44	-09	-04	-10	35	-11	-20	-30	-12	14	34	-41
KTK	-40	-20	16	32	-05	12	-40	-34	12	34	11	-13
number memory	-43	-10	28	-24	-00	07	-35	-24	-36	-16	37	-20
sentence memory	-45	-13	09	-07	-09	16	-18	-26	-04	-13	45	-12
letter memory	-45	-07	21	-02	-06	13	-19	-21	-24	-15	31	-22
word memory	-40	20	20	-06	-28	06	05	-08	-21	-10	08	-08
visual memory	16	16	02	-08	-21	-46	09	-23	-20	45	-02	-46
task memory	-34	26	06	-05	-21	-25	-14	-31	30	31	30	-16
verbal analogies	-36	-27	-01	-28	04	09	-00	-18	-13	-35	29	-02
block analogies	-24	-25	10	20	25	14	-31	-44	-16	-11	22	-31
picture seriation	05	-51	27	21	14	-21	11	00	-26	-19	20	-33
Raven	-17	04	-10	01	-00	08	-39	-01	-06	-01	-03	-21
concept formation	08	-22	06	12	21	-09	-06	-34	-18	-02	-09	-32
picture ordering	-45	-07	-10	07	50	21	-46	-19	11	19	08	-28

$r \geq .34$, $p < .05$
$r \geq .45$, $p < .01$

Appendix 3. Intercorrelations between the interactional and environmental variables

Table 4. Intercorrelations between variables describing the mother's interaction and the children's environment

Variables	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
1. Number of the mother's gestures towards the material		.58	.22	.25	.24	.32	.11	.59	.21	.05	.31	.07	.48
2. The mother's eye-contacts towards the child			-.33	.37	.61	.44	.01	.41	.34	.38	.47	.38	.73
3. Non-verbal reinforcement				.01	-.03	-.03	-.32	-.02	.12	.02	.08	-.06	.03
4. Comments					.33	.52	.09	.37	.46	.62	.53	.73	.52
5. Repetitions corrected to sentence						.44	.15	.36	.19	.30	.40	.37	.56
6. Comments including additional information about the item							-.02	.50	.59	.42	.52	.43	.37
7. Thanking for correct performances								.37	.22	.45	.51	.32	.40
8. Variation of intonation									.31	.31	.54	.39	.66
9. Explanations supporting child's correct performance										.50	.71	.45	.32
10. Adequate guidance in tasks											.64	.86	.54
11. Amount of the mother's communication in interaction situation												.59	.68
12. Flexibility of mother in interaction													.50
13. The mother open and spontaneous in interaction													
14. The mother good-humoured in interaction													
15. The mother co-operative in interaction													
16. The mother's linguistic code													
17. Social status of the family													
18. The mother's explanation for use of time													
19. Number of toys used by the child													
20. Quality of toys													
21. Most important qualities of toys according to the mother													
22. The mother's daily use of time when the child is awake													
23. The mother's satisfaction with her work													
24. Explaining behaviour to the child													

$r \geq .31$, $p < .05$

$r \geq .42$, $p < .01$

14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.
.18	.24	.12	-.01	.04	-.01	.00	.21	.18	-.07	.05
.39	.56	.43	.22	.19	.41	.33	.37	.53	.14	.44
-.12	-.05	.19	.21	.07	.18	.10	.13	.20	.42	-.00
.39	.40	.54	-.03	-.01	.32	.46	.08	.23	.15	.27
.43	.45	.52	.34	.27	.09	.17	.41	.43	.03	.60
.07	.13	.56	.20	.33	.14	.39	.18	.30	.18	.46
.51	.43	.41	-.27	-.26	-.06	-.12	-.10	-.01	-.20	.10
.41	.38	.41	.02	-.06	.21	.23	.30	.20	-.09	.28
.17	.27	.57	.25	.21	.41	.62	.20	.15	.04	.19
.58	.64	.74	-.03	-.04	.38	.39	.10	.35	.10	.32
.42	.49	.70	.04	-.02	.47	.55	.33	.40	-.11	.40
.45	.62	.36	.16	-.03	.50	.59	.31	.36	.11	.47
.63	.70	.43	-.02	-.07	.48	.36	.33	.56	-.06	.46
	.74	.35	-.11	.04	.20	.00	.17	.06	-.23	.29
		.51	.13	.07	.39	.32	.29	.37	-.15	.29
			.27	.19	.21	.44	.28	.41	.15	.48
				.48	.31	.49	.44	.33	.43	.26
					.10	.20	.41	-.06	.17	.24
						.81	.55	.34	.09	.38
							.52	.50	.12	.43
								.17	-.17	.47
									.19	.56
										.02

Appendix 4. Intercorrelations between the linguistic and cognitive skills

Table 5. Intercorrelations between children's linguistic and cognitive skills

Variables	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
1. Picture vocabulary test		.63	.15	.27	-.18	-.41	-.11	.23	.30	.04	.10	.20	.21	.05
2. Comprehension of morphological forms			.17	.25	-.09	-.17	.07	.31	.26	-.12	.20	.30	.37	.00
3. Production of morphological forms (model)				.84	.57	.46	.74	.90	.19	.31	.48	.41	.35	.64
4. Production of morphological forms (correctness)					.44	.30	.73	.90	.11	.10	.40	.32	.38	.49
5. Linguistic code						.72	.73	.52	.07	.12	.31	.24	.09	.60
6. Sentence structure of utterances							.65	.40	-.05	-.03	.34	.18	-.17	.47
7. Many-sideness of vocabulary in interaction								.77	.00	.00	.32	.25	.07	.56
8. Level of spontaneous speech									.21	.12	.51	.44	.45	.63
9. Comparison of size										.32	-.19	.27	.53	.33
10. Perceiving similarities											.10	.14	.36	.21
11. Mastery of concept quantity												.29	.20	.36
12. Distinction between the biggest/smallest thing													.30	.53
13. Visual memory														.35
14. Cognitive level of games														

$r \geq .31$, $p < .05$
$r \geq .42$, $p < .01$

Table 6. Relations between single background variables and children's linguistic-cognitive factors

Criterion variable	Combinations of two prediction variables	Multiple correlation	Significance of correlation	df	p	%
Factor I (The Factor of Speech production; production of morphological forms, many-sidedness of vocabulary, level of spontaneous speech)	1. Explanations supporting the child's correct performance Quality of toys	.61	6.83	2/23	.01	37.2
	2. Comments (mother's way to reinforce) Explanations supporting the child's correct performance	.61	6.83	2/23	.01	37.2
	3. Comments Quality of toys	.61	6.72	2/23	.01	37.2
Factor II (The Factor of Speech comprehension; comprehension of morphological forms, picture vocabulary test)	1. Mother's eye-contacts towards the child Comments	.33	1.45	2/23	ns.	10.9
Factor III (The Factor of Ability to conceptualize perceptions; comparison of size, perceiving similarities, visual memory)	1. Explanations supporting the child's correct performance Mother's satisfaction with her work	.49	3.60	2/23	.05	24.0
	2. Comments Explanations supporting the child's correct performance	.47	3.39	2/23	.05	22.1
Factor IV (The Factor of Linguistic interaction; linguistic code, sentence structure of utterances, cognitive level of plays)	1. Quality of toys Explaining behaviour to child	.62	7.10	2/23	.01	38.4
	2. Flexibility of mother in interaction situation Explaining behaviour to child	.61	6.91	2/23	.01	37.2
	3. Mother's linguistic code Quality of toys	.61	6.77	2/23	.01	37.2