2-5-1993

Language and Memory Development in the Three and Four Year Old

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AN ABSTRACT OF THE THESIS OF Caroline Prater Moffatt for the Master of Science in Speech Communication: Speech and Hearing Sciences presented February 5, 1993.

Title: Language and memory Development in the Three and Four Year Old.

APPROVED BY THE MEMBERS OF THE THESIS COMMITTEE:

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Although there is agreement in the literature that memory is required for language, there is disagreement as to whether certain memory abilities are prerequisite for language. There has been a significant amount of research in the field of memory development as it relates to language; however, little research has been done in the area of memory and language development in the preschool

aged child.

This study examined two aspects of auditory memory and language development in the preschool child: (a) the auditory memory abilities of delayed language children versus normal language children, and (b) determining if there is a relationship between auditory memory and language development.

The subjects used in this study included 14 "normal talkers" and 14 children with "slow expressive language development" (SELD), as determined by the Language Development Survey (Rescorla, 1989) given when the subjects were between 24-34 months of age. When the subjects were 3 years-old they were given the verbal and digit imitation section of the Preschool Language Scale (PLS) as a measure of auditory short-term memory. The results were compared with the Test of Auditory Comprehension of Language-Revised (TACL-R), the Developmental Sentence Scoring (DSS) and the Northwestern Syntax Screening Test (NSST-E) all given at age three. A further comparison was made with the PLS and the Test of Language Development-Primary (TOLD-P) and the DSS, given at age 4. The Spearman rank correlational statistic was used to determine if a significant relationship existed between memory and language development as seen on the PLS (age 3) and the other language measures given at ages 3 and 4.

This study showed that SELD children performed more

poorly on verbal and digit memory tasks than their normally speaking peers. Correlational analysis revealed that the PLS-Digit and the PLS-Sentence memory recall tasks were significantly correlated with the DSS given at the same point in time for the normal group, and between the PLS-Sentence and the NSST-E given at the same time for the SELD group. This suggests that a relationship exists between memory and expressive language at the same point in development. Because the relationship exists at the same time, and not across-ages, these findings seem to support the theory that language and memory are related in development, but memory skills at one time do not predict language skills at another.

As language and memory seem to be related at the same point in time, testing auditory short-term memory skills in children with language delays will not add new information above what is learned in language testing itself. Further research in this area might investigate whether, as some literature suggests (Kail, 1990), teaching memory strategies to young children with language delays may improve language learning.

LANGUAGE AND MEMORY DEVELOPMENT IN THE THREE AND FOUR YEAR OLD

by

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A thesis submitted in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE
in
SPEECH COMMUNICATION:
SPEECH AND HEARING SCIENCES

Portland State University

1993

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ACKNOWLEDGEMENTS

This is dedicated to my family, Al, John and Michelle, for putting up with me throughout this project and my graduate career.

I would like to thank the members of my thesis committee, Joan McMahon and Dr. Marjorie Terdal, for their time and advice. I would especially like to thank my thesis chairperson, Dr. Rhea Paul, for all her patience and rewrites over the last year -- I could not have done it without her!

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INTRODUCTION AND STATEMENT OF PURPOSE

INTRODUCTION

Interest in the study of children's memory development can be traced back to the late 1800's, when the study of psychology was a new discipline. Jacobs, in 1887, and Kirkpatrick in 1894, found age differences in digit span recall. Binet and Henri, also in 1894, began studying recall of related and unrelated words. At the turn of the century, memory research was limited to the study of the relationship between memory and intelligence. It was not until the 1960s that researchers focused on the diagnostic aspects of the memory span test, and attempted to understand factors that might be responsible for age related improvements (Chi, 1976;. Ornstein, 1978; Flavell, 1985).

The relation between children's memory skills and their language ability has also been of interest. Some authors (Clarke-Stewart, Perlmutter & Friedman, 1988; Carter, 1989; Chalfant & Scheffelin, 1969; Atkinson & Shiffin, 1971) suggest that children have language problems that may result from deficient memory skills as they depend on auditory memory for the development of communication.

The present study examines performance on memory tasks in children with normal and delayed language development. Its intent is to investigate the role played by memory in language development and delay.

Whereas memory span tests of digits examine short-term memory (STM) alone, the ability to repeat sentences relies on both STM and long-term memory (LTM) (Zimmerman, Steiner & Pond, 1979). Both STM and LTM are an intergral part of language processing as they bring together linguistic, cognitive and perceptual abilities (Carter, 1989; Wiig & Semel, 1984; Wiig & Semel, 1976). Information is stored in STM for up a few seconds to 1 minute before it is retained in LTM or forgotten (Ault, 1983; Carter, 1989; Adams, 1976; Chalfant & Scheffelin, 1969). In LTM the perceived stimulus is recognized and identified. Without LTM, all incoming data would appear new and unique no matter how repetitious (Flowers, 1983).

Both LTM and STM are involved in language development; more specifically, auditory short-term and long-term memory are important in the acquisition of language (Wiig & Semel, 1984; Chalfant & Scheffelin, 1969). Auditory short-term memory (ASTM) involves the ability to discriminate sounds and combine them into words and sentences. This discrimination is thought by some to be a major stepping stone for the development of syntax (Carter, 1989; Mountain, 1980; Witkin, 1971).

ASTM is comprised of two subskills: span (the maximum number of words, digits or syllables retained after one presentation), and sequence, or the recall of a series of sounds in the correct order after one presentation (Carter, 1989; Cofer, 1976; Aten, 1974). Span and sequence development are held by some authors (Carter, 1989; Atkinson and Shiffen, 1971; Cofer, 1976; Adams, 1976) to be especially important to language development as the child relies on ASTM to remember incoming stimuli, to order the stimuli into words and sentences, and to respond correctly. An alternative view to the theory that memory skills are a prerequisite for language ability is presented by Lahey (1988), Bloom and Lahey (1978), Olson (1973), and Speidel and Herreshoff (1989). According to these theorists, language development itself affects STM, as the child uses language to increase skill and strategy for storing and retrieving auditory information.

RATIONALE

Language and communication development are thought by some authors to be dependent upon a working auditory memory system, (Carter, 1989; Rosenblum, 1979). This study will determine if auditory memory testing at age three can predict later language ability in children with normal and delayed language development. The study will test the hypothesis that auditory memory ability is a prerequisite

for language development, and that memory deficits in children with language delays are correlated with their progress in language skills.

STATEMENT OF PURPOSE

The purpose of this study is to investigate the relationship between the auditory memory skills of 3 year-olds with normal and delayed language development, and the language ability of the same children tested at ages 3 and 4. The research hypotheses of the study are that 1) auditory memory skills in children with delayed language will be poorer than those of children with normal language development, and 2) that auditory memory skills have a positive correlation with language development. The specific question to be investigated is: is there a correlation between the results of the Verbal (PLS-Sentence) and Digit (PLS-Digit) imitation section of the Preschool Language Scale (PLS), with the Developmental Sentence Scoring (DSS-age 3), the Northwestern Syntax Screening Test (NSST-E), and the Test of Auditory Comprehension of Language (TACL-R) at age 3, and with the DSS (DSS-age 4), and the Speaking (TOLD-S) and Listening (TOLD-L) section of the Test of Language Development (TOLD-P) given at age 4?

The Research Hypothesis. The research hypotheses for this study are that auditory memory skills are depressed in

children with delayed language and that auditory memory skills have a positive correlation with language development.

The Null Hypothesis. The null hypothesis is that memory is not necessarily a prerequisite to language, but the two abilities are related in a more general way without one necessarily being a prerequisite to the other.

DEFINITION OF TERMS

Auditory long-term memory: The memory of auditory experiences that modifies all perception and makes possible the recognition and identification of the many sounds occurring in the environment (Flowers, 1983).

Auditory short-term memory: Holds and retrieves information for a short period of time (1 second to 1 minutes) (Wallace & McLoughlin, 1988; Clarke-Stewart et al., 1988).

Auditory short-term sequential memory: Retrieving information in the same order received (Wallace & McLoughlin, 1988).

Auditory short-term memory span: Retention and recall, not necessarily in sequential order (Burford, 1976). The maximum number of digits, words or syllables retained after one presentation (Cofer, 1976).

Normal talkers: Children whose parents reported the use of more than 50 different words and used productive two

word combinations at age 24-34 months on the Language Development Survey (Rescorla, 1989).

Recall: Process of remembering, reconstructing and activating language stored in memory (Wiig & Semel, 1984).

Recognition: Process of recognizing a previous stimulus and matching that stimulus to stored memory (Wiig & Semel, 1984).

Retrieval: Process of bringing back language from storage in memory for production and use in spoken language (Wiig & Semel, 1984).

Slow expressive language development (SELD) group: Children who, at 24-34 months of age, used fewer than 50 different words or no two word combinations, as reported by parents on the Language Development Survey.

CHAPTER II

REVIEW OF THE LITERATURE

The literature available covers many types of memory, including long-term and short-term memory. Within both LTM and STM different types of memory can be found, including: auditory or echoic memory which is imitation of a sound; visual or iconic memory which is recall of visual images; and enactive memory, or recall of motoric activity. As auditory memory would appear to be a natural precursor to language development, this review will focus on findings within auditory memory with special attention to auditory short-term memory tasks.

AUDITORY MEMORY SKILLS: TYPES AND TERMINOLOGY

Auditory Short-term Memory

One way STM receives stimuli is through echoic, or auditory modalities (Davis, 1984; Gerber, 1981). Auditory short-term memory is defined by Adams (1976) as input items being held in unprocessed sensory form by the listener. Auditory short-term memory is the ability to temporarily retain the characteristics of a sound or series of sounds (Davis, 1984; Heasley, 1974; Flowers, 1983).

Auditory short-term memory consists of two subskills:

span and sequence (Wallace & McLoughlin, 1988; Heasley, 1974). Auditory memory span and sequence are necessary to discriminate and order incoming stimuli to respond in an appropriate manner (Carter, 1989; Davis, 1984; Atkinson & Shiffin, 1971).

Span. Auditory short-term memory span is the temporary retention of a sequence of events or words associated together for immediate reproduction (Case, 1985; Flowers, 1983; Masland and Case, 1968). The number of related or unrelated items that can be recalled immediately after presentation makes up the auditory memory span. Auditory memory span holds digits, letters, isolated words and words in sentences for recall (Cantwell & Baker, 1987; Cofer, 1976). By increasing the number of stimuli presented, the amount the child or adult is able to retain and retrieve is tested (Kail, 1990; Flavell, 1985; Hulme, Thomas, Muir & Lawrence, 1984; Chalfant & Scheffelin, 1969).

LaBenz and Fay (1980) tested the ability to repeat a series of digits and words after one presentation, for three to eight year olds on digit span, syllables and spondaic words memory tests. Ninty-three percent could repeat a 2 digit series, 74% could repeat 3 digit series, 95% were correct on 2 syllable word series and 78% on 3 syllable word series. According to Zimmerman, Steiner and Pond (1979), at 2-6 to 3 years, the ability to repeat a 3 digit series is representative of an increasing ability in listening skills

and in STM. Table I shows Chi's (1976) comparison of average digit, word and letter recall, plus or minus 1, at age 5 and at adulthood.

TABLE I

CAPACITY OF STM, PLUS OR MINUS 1

AGE	DIGIT	LETTER	WORD
5	4.3	3.69	4.3
Adult	7.98	7.21	5.86

Source: Chi, 1976

Commonly, repetition of digits is used to measure auditory short-term memory span (Boyd & Hooper, 1987; Case, 1985; Wepman & Morency, 1973; Carrow, 1974). Digit recall is common in intelligence testing. Although some researchers (Schofield & Asman, 1986; Chase, Lyon & Ericsson, 1984; Nicolson, 1984; Wepman & Morency, 1973; Olson, 1973) have found that forward and backward digit span, chronological age and IQ are highly correlated (.50 - .60), others (Torgesen, 1990) suggests that memory span tasks are not highly correlated with general intelligence. As a diagnostic tool, digit span gives estimates of a child's ability to learn; however, it does not necessarily indicate a high degree of comprehension, only the possibility of retention of comprehended auditory stimuli (Gardner, 1985). The use of digit span is perceptual because it requires repetition without meaning and therefore

utilizes many of the processes that determine the functional storage capacity of short-term memory (Torgesen, 1990; Wepman & Morency, 1973; Gardner, 1985). Immediate recall of auditory stimuli is thought by some researchers to be necessary for adequate intellectual functioning and the development of language skills (Wiig & Semel, 1984; Wiig & Semel, 1976). However, Cantwell & Baker (1987) agree that representation of digits, words and sentences can be indicative of auditory memory deficits, they feel that performance on repetition of nonsense words and strings of unrelated words is more specifically related to language dysfunction.

Sequence. As with auditory memory span, sequencing is thought to be critical in language development, comprehension and expression (Wallace & McLoughlin, 1988; Heasley, 1974; Carrow, 1974). Auditory short-term sequential memory allows for the retention and reproduction of auditory information in sequential order (Wallace & McLoughlin, 1988; Faas, 1980). Tasks used to measure this ability include repetition of nonmeaningful digits and unrelated words (Faas, 1980; Wallace & McLoughlin, 1988). Readiness for syntax is thought to be dependent upon the number of verbal items a child can hold in sequential order for immediate recall and use (Carter, 1989; Wepman & Morency, 1973).

Long-term memory

Whereas STM temporarily holds incoming auditory

information, LTM gives meaning to the input. If a child can not relate a portion of the surface structure, or utterance, to his or her existing deep structure knowledge base for meaning, the sentence will be recalled in the same way as an unrelated series of words (Lahey, 1988; Carrow, 1974; Olson, 1973). Familiarity of the words and grammatical sequences used, and the retrieval of words from LTM permit the comprehension of linguistic information (Flowers, 1983). A child must be able to store, assimilate and retrieve information from LTM in order for language comprehension to be accomplished (Clarke-Stewart et al, 1988; Carter, 1989; Lerner, 1971).

Sequence. Tasks used to measure long-term sequential memory include repetition of sentences, counting, and reciting the alphabet and the days of the week (Faas, 1980; Wallace & McLoughlin, 1988).

LANGUAGE AND MEMORY

Repetition of sentences for immediate recall depends on STM for span and LTM for the application of deep structure or meaning (Speidel, 1989; Clarke-Stewart et al, 1988; Olson, 1973), which in turn provides the basis for sequence. A child will omit from the surface structure those linguistic elements which cannot be related to deep structure for meaning (Lahey, 1988; Bloom & Lahey, 1978; Olson, 1973; Wepman & Morency, 1973). Without meaning from

the deep structure, the sentence imitated would be limited by STM span. Without information from LTM, children would not be able to repeat sentences with more words than the number of unrelated digits their short-term memory span was able to retain (Lahey, 1988; Carrow, 1974). Therefore, sentences presented for immediate recall help to determine what the child already understands about the structure of the sentences (Lahey, 1988; Bloom & Lahey, 1978). As a result, children will process sentences which exceed their auditory memory span only if the sentence structure is understood. If the structure is not understood, the child will treat the sentence as a word list (Lahey, 1988; Carrow, 1974). From immediate imitation of the sentence it is thought to be possible to determine what is understood of the content and structure of the sentence (Lahey, 1988; Cantwelll & Baker, 1987; Bloom & Lahey, 1978; Carrow, 1974). This argument also suggests that language skill itself can affect performance on memory for sentence tasks. If a child has not mastered the language found in the sentence, the sentence will be repeated at the level of language ability the child does have.

Sentence repetition involves the recall of the temporal order of elements within sentences (Carter, 1989; Masland & Case, 1968). The sequence of the words within a sentence is determined by the syntactic rules of the language; therefore, it may be inferred that the inability to remember

sequences might interfere with the ability to internalize the syntactic order and rules of the language (Carter, 1989; Masland & Case, 1968).

Conversely, the inability to repeat sentences may reflect a lack of syntactic knowledge which would result in the appearance of depressed performance on sentence memory tasks. This model of language processing holds that memory is not necessarily a prerequisite to language, but rather that auditory sequential recall tasks are an indicator of linguisitc familiarity (Lahey, 1988; Bloom & Lahey, 1978). Performance deficits in young children on short-term memory tasks are seen in this view as the result of failure to organize, plan and integrate new information effectively, or the inability to use deep structure knowledge to aid recall (Olson, 1973; Huttenlocher & Burke, 1976). Further, poor auditory memory span in language disordered children may be due to the language deficit itself and not a processing ability (Lahey, 1988; Bloom & Lahey, 1978).

SUMMARY

This study will address the question of whether performance on ASTM tasks can predict later language development. ASTM skill is thought by many authors reviewed here to be a prerequisite for later language ability (Carter, 1989; Clarke-Stewart et al, 1988; Chalfant & Scheffelin, 1969; Witkin, 1971; Faas, 1980; Adams, 1976;

Gerber, 1981). If this theory is correct then this study would expect to find that children with delayed language are poorer in ASTM than normal peers, and that there will be a correlation between ASTM ability at age 3 and language at age 4. It would agree with the model which holds that auditory memory allows for recognition and discrimination of units within sentences. Further, it would suggest that auditory memory sequencing is most critical in language development as it allows for the serial reproduction of information from memory (Faas, 1980).

If language itself contributes to the performance on ASTM tasks, as Lahey (1988) and Bloom and Lahey (1978) claim, then a correlation might be found between ASTM and language at age 3, but the correlation of ASTM and language at age 4 would be less strong than the correlation of language ability at 3 and 4. ASTM and language at age 3 would be related in that language skill would influence ASTM, as this model predicts, but language itself would be a better predictor of later language ability than would ASTM. This finding would support the notion that language ability has a greater effect on memory performance than vice versa.

CHAPTER III

METHODS AND PROCEDURES

SUBJECTS

The subjects used for this study are participants in the Portland Language Development Project (PLDP), a longitudinal study of early language delay.

This study was concerned with a comparison between two groups of children: a group with slow expressive language development (SELD, n= 14) and a group with normal language development (NL, n= 14). The Language Development Survey (LDS) (Rescorla, 1989) was used to determine group assignment. The LDS is a parent questionnaire consisting of a checklist of the 300 most common words in children's early vocabularies and a section questioning parents on children's use of word combinations. Rescorla (1989) reports high reliability, validity, sensitivity, and specificity for use of the LDS to identify language delay in this age range. SELD is defined in this study as the use of fewer than 50 different words or no use of two word combinations at age 24-34 months as reported by parents on the LDS. NL is defined as the use of more than 50 different words on the LDS, and the use of productive two-word combinations at this age level.

Recruiting Procedures

Two procedures were followed in recruiting the subjects. In the first procedure, receptionists and nurses handed out questionnaires to parents bringing in their children for 15 and 24 month well-baby checks. Based on the information provided by the parents, the children were classified as having SELD or normal expressive language as determined by the criteria above.

The second procedure was to contact parents who responded to a local newspaper ad or radio news station requesting speech-delayed toddlers to participate in a longitudinal study. The same questions were asked of these parents and a classification of SELD or normal was made for each child. All parents of children identified as SELD were invited to join the longitudinal study. A control group of NL families, selected to match the SELDs on the basis of age, sex ratio and SES, was also invited to participate.

Subject Selection for Current Study

The subjects who participated in the current study were selected from the pool of subjects in the PLDP. For both the SELD and the normal groups, 93% were Caucasian (see Table II). The mean socio-economic level, based on Myers and Bean's (1968) modification of the Hollingshead four factor scale of social status, was 2.6 for the normal group and 3.0 for the SELD group. This places the two groups in

TABLE II

DEMOGRAPHIC INFORMATION FOR THE NORMAL AND SELD GROUPS

Normal					SELD				
#	Age (months)	Sex	Race	SES	#	Age (months)	Sex	Race	SES
14	37	M	W	1	6	36	M	W	2
51	38	F	W	4	7	36	M	W	2
55	38	F	W	3	29	38	F	W	5
58	42	M	W	1	53	40	M	W	4
63	36	M	W	3	54	43	M	W	3
72	37	M	W	4	57	42	F	W	4
95	36	M	W	3	85	37	M	W	3
128	38	M	W	2	87	37	F	W	3
130	38	M	W	3	92	43	M	W	3
131	39	M	W	2	102	40	M	W	2
132	36	M	Mix	1	105	37	M	W	4
133	36	M	W	4	114	36	M	Mix	2
144	38	M	W	4	115	44	M	W	3
150	37	F	W	1	119	36	M	W	2
Total:	N = 14, 73% male X age: 37.6 months X race: 93% White X SES: 2.6				N = 14, 73% male X age: 39.0 months X race: 93% White X SES: 3				

the middle to lower-middle class. All children passed a hearing screening at 25dBHL and scored at least 85 on the Bayley Scale of Infant Development (Bayley, 1969). Children in both groups were included only if they had no

known physical handicaps, mental retardation, neurological disorders or autism. Children were seen for longitudinal follow-up at ages three and four.

For the present study, NL and SELD groups were selected so as to be matched on the basis of sex ratio and scores on the Harris-Goodenough (Goodenough & Harris, 1963) Draw-a-Person (DAP) test, used as an index of nonverbal cognitive maturity (see Table III). The Draw-A-Person mental age validity as compared to the Standford-Binet and the WPPSI is included in Table IV (Harris, 1963). The SELD group involved in the present study had 11 males and 3 females (73% male) with a mean age at the three year follow up evaluation of 39 months and a standard deviation of 2.57. The normal group had 14 subjects with 11 males and 3 females (73% male). The average age at the three year follow up evaluation for the NLs was 37.6 months (s.d. 9.0).

PROCEDURES

The first indepth evaluation of the children for this longitudinal study was made at intake into the PLDP in 1987, at age 2. During the intake assessment, the parents signed permission forms to participate in the study (Appendix A). At this time they were given the LDS. All subjects retained their original diagnostic group classification by this measure. Indepth assessment of language and related skills were carried out at this time (Paul, 1991).

TABLE III

RESULTS OF THE SELD AND NORMAL GROUPS MATCHED ON DRAW-A-PERSON FOR NONVERBAL COGNITIVE MATURITY

NORMAL			SELD		
Subject	DAP	Sex	Subject	DAP	Sex
14	105	M	6	--	M
51	134	F	7	108	M
55	103	F	29	103	F
58	93	M	53	93	M
63	108	M	54	91	M
72	--	M	57	100	F
95	108	M	85	--	F
128	103	M	87	133	F
130	111	M	92	91	M
131	100	M	102	98	M
132	152	M	105	166	M
133	105	M	114	108	M
144	103	M	115	--	M
150	108	F	119	108	M
Total:					
N:	14, 73% male		N:	14, 73% male	
X IQ:	110		X IQ:	109	
SD:	15.7		SD:	22.0	
Range:	93-152		Range:	91-166	

Follow-up

Subjects were seen for yearly reevaluations of language and related skills at age 3 and again at age 4. At age 3,

the normal and SELD group were given the Verbal/Digit Imitation section of the Preschool Language Scale (PLS) (Zimmerman, Steiner and Pond, 1979) (Appendix B), the expressive portion of the Northwestern Syntax Screening Test (NSST-E) (Lee, 1971) (Appendix C), and the Test of Auditory Comprehension of Language- Revised (TACL-R) (Carrow, 1985) (Appendix D). The Developmental Sentence Scoring (DSS) (Lee, 1974) (Appendix E) was obtained by analyzing a 10 minute language sample collected during free play between the mother and child at ages 3 and 4. At age 4 the children were also given the Test of Language Development-Primary (TOLD-P) (Newcomer, Hammill, 1988) (Appendix F). The DSS was obtained again at age 4, using procedures similar to those used at age 3.

TABLE IV

MENTAL AGE VALIDITY
FOR THE DRAW-A-PERSON

MEASURE	NUMBER IN STUDY	AGE	VALIDITY (Pearson r)
Standford-Binet	100	3-15	r = .80
	116	4	r = .74
		5	r = .78
WPPSI	--	5	r = .72 - .80

INSTRUMENTS

At age 3 the subjects were given the PLS, the NSST, the TACL-R and the DSS. At age 4 the same subjects were given the TOLD-P and the DSS (Table V).

TABLE V

MEASURES GIVEN TO SUBJECTS AT AGES 3 AND 4

AGE	PLS	NSST-E	TACL-R	DSS	TOLD-P
3	X	X	X	X	
4				X	X

Preschool Language Scale

Both groups of children were given the Verbal/Digit Imitation section of the Preschool Language Scale (PLS) at the follow-up evaluation when subjects were 3 years old. The PLS is designed to test verbal and auditory ability in children 1-6 to 7 years. The Verbal/Digit Imitation section tests repetiton of digits and sentences at 2 to 2-6 years and at the 2-6 to 3 year levels. Although not standardized, the items in the PLS were taken from existing standardized intelligence and developmental scales (Young, 1984). For ages 2 to 2-6 the PLS Digit Span Section (PLS-Digit) tests recall of 2 digits given auditorily. At 2-6 to 3-0 the repetition of three digits is tested to measure the child's increasing STM span and listening ability. At both age levels, verbal repetition of short sentences is tested in the PLS-Sentence Imitation Section (PLS-Sentence). Whereas digit span tests listening ability and short-term memory development, sentence recall tests the preceding as well as language knowledge.

Northwestern Syntax Screening Test

The Northwestern Screening Syntax Test- Expressive (NSST-E), is a screening instrument designed to estimate deviant syntactic development between 3 and 8 years. It was given at the 3-year-old evaluation of the PLDP. The NSST-E tests receptive and expressive ability; however, the 3-year-olds in this study were only given the expressive portion. The expressive portion requires delayed sentence repetition, which combines expressive and receptive skills. The results can be compared against norms developed for each age group.

Test of Auditory Comprehension of Language Structure of Children, (TACL-R)

This test is a standardized test of auditory comprehension involving vocabulary, grammar and syntax. This test was administered at the 3-year evaluation.

Developmental Sentence Scoring, (DSS)

The DSS quantifies grammatical structures of expressive language. The DSS is frequently used in evaluating synatatic and morphological development in preschool children. Normative data are available for each age group from three through 8 years. This measure was collected from subjects at both three and four years of age.

Test of Language Development- Primary, (TOLD-P)

The TOLD-P is a standardized measurement device used to determine children's strengths and weaknesses in language

skills. Composite scores are given for spoken language, listening, speaking, semantics, syntax and phonology. This test was given at the four-year evaluation.

Reliability

Reliability was obtained by having a second scorer record the responses of 10% of the subjects seen at the three year evaluation. Point-to-point inter-scorer reliability for the PLS-Digit reliability was 100%, and on the PLS-Sentence reliability was at 83%.

Reliability for the DSS scores was completed by having a second scorer independently rescore 10% of the transcripts from each of the 3 and 4 year evaluations. Point-to-point reliability for DSS points awards was 89.5% for the three year evaluation and 91.8% for the 4 year evaluation.

ANALYSIS AND DESIGN

To investigate the relationship between memory and language, a correlational design was utilized. This tests for an association between memory and language development, as seen in the standardized testing.

The data from the Verbal/Digit Imitation section of the Preschool Language Scale was coded as to the total number of correct responses of sentence imitation (PLS-Sentence score) and digit span (PLS-Digit score).

Statistically, the data from the PLS are not normally distributed so a non-parametric, correlational statistic,

the Spearman rank-difference correlation, which scores and ranks each variable, was used for data analysis.

The smaller the difference between the summed ranks in each group, the higher the correlation between memory and language development. This would support the hypothesis that memory skills have a positive correlation with language development.

If the difference between summed ranks is large, the hypothesis would be rejected, and the study would fail to suggest a correlation between memory and language. This would support the theory proposed by Lahey (1988), Bloom and Lahey (1978) and Olson (1973) which says that STM skills are not a prerequisite for language development.

CHAPTER IV

RESULTS AND DISCUSSION

RESULTS

The specific objective of this study was to determine whether children with delayed language are poorer at memory skills than children with normal language and whether memory testing at age 3 can predict later language ability.

The research questions asked were: 1) Do SELDs score significantly lower on memory measures than the normal talkers, and 2) is there a correlation between the results of the Verbal/Digit Imitation section of the Preschool Language Scale, with the Developmental Sentence Scoring, the Northwestern Syntax Screening Test, and the Test of Auditory Comprehension of Language Structure of Children, at age 3, and the Developmental Sentence Score, and the Speaking and Listening sections of the Test of Language Development given at age 4 (See Appendix G for results and data type).

The study showed that SELD children do perform more poorly on STM and LTM tasks than do their normally speaking peers. The relationship between the PLS-Digit and PLS-Sentence memory tasks and the various expressive and receptive tasks found few significant correlations, resulting in a failure to reject the null hypothesis of no

relationship between early memory development and later language ability.

The means and standard deviations of the SELD group and the normal group were computed for each of the dependent variables. A t-test comparing the mean values of each variable for both groups was computed. The results are in Table VI. The test-statistic indicated that there was

TABLE VI

MEAN, t-TEST, STANDARD DEVIATION AND RANGE OF EACH GROUP FOR EACH OF THE DEPENDENT MEASURES

Measure	Group	Mean	t-test	S.D.	Range H	Range L
PLS-Digit	Normal	5.14	3.51*	1.1	6	2
	SELD	3.0		2.0	6	0
PLS-Sentence	Normal	3.0	5.29*	2.0	4	1
	SELD	.786		1.25	4	0
NSST-E	Normal	9.36	2.91*	8.0	21	0
	SELD	2.14		4.67	18	0
TACL-R	Normal	36.6	1.35	8.96	63	22
	SELD	29.78		16.6	77	9
DSS-age 3	Normal	5.42	2.79*	1.65	8.16	2.72
	SELD	3.75		1.51	6.12	.430
DSS-age 4	Normal	6.55	.331	1.50	8.62	4.07
	SELD	6.37		1.37	8.18	4.10
TOLD-Listening	Normal	31.9	2.49*	6.46	39	29
	SELD	24.57		8.93	41	12
TOLD-Speaking	Normal	42.12	2.12*	6.0	53	36
	SELD	37.14		6.46	49	26

* Significant at $p < .001$.
d.f. = 26

a significant difference ($p < .001$) between the normal and SELD groups on all variables except for the TACL-R (given at age 3) and the DSS-Age 4. The differences between the means on memory tasks at age 3 were significant; however, the DSS-age 4 showed no significant difference between the two groups.

The data were further analyzed, using the Spearman rank correlation coefficient, to determine if, in the normal or SELD group, a correlation existed between digit and sentence memory recall at 3 and language development at 4. The results of the Spearman rank correlation can be seen in Table VII.

TABLE VII

RESULTS OF THE SPEARMAN RANK CORRELATION COEFFICIENT FOR THE NORMAL AND SELD GROUPS

Dependent Variable	PLS-D		PLS-S	
	Normal	SELD	Normal	SELD
NSST-E	-.0923	.2688	.1532	.5069*
TACL-R	.4020	-.1526	.0538	-.0716
DSS-age 3	.4569*	.0223	.5479*	.0395
DSS-age 4	.2598	-.0056	.1646	.1000
TOLD-Listening	.0940	-.0412	-.0744	-.0321
TOLD-Speaking	.0157	.2031	.4028	.2735

* Significant at $p < .05$.

Correlation with the PLS-Digit

A correlation (at .05 level of significance) was found

between the PLS-Digit and the DSS-age 3 for normal talkers. This indicates there may be a correlation between STM as measured by digit recall and the expressive language abilities of a normal child at the same age.

No significant correlations were found among the PLS-Digit and the remaining dependent variables. This does not necessarily indicate that a relationship does not exist between these variables, only that there is insufficient evidence to conclude that a correlation exists.

Correlation with the PLS-Sentence

Within the normal group, a positive correlation (at .025 level of significance) was found between the PLS-Sentence and the DSS-age 3. Because the PLS-Digit also correlated with the DSS-age 3, this could indicate a relationship between memory at 3 and expressive language at 3 within a normal population.

The NSST-E, an expressive sentence recall measure, was significantly correlated with the PLS-Sentence among the SELD population. As the PLS-Sentence and the NSST-E both test sentence recall, a correlation between these measures is not surprising.

No significant correlations were found with the remaining dependent variables within either group.

DISCUSSION

This study suggests that few significant correlations are seen between early memory and later language development. As can be seen in Table VI, the mean scores for the normal and SELD group were significantly different in all areas except the TACL-R and the DSS-age 4. The SELD group performed significantly more poorly on memory recall and on a variety of expressive language tasks at age three when compared to normal peers. However, by age 4 no significance in one measure of expressive language was seen, although there was a difference on another measure. This could be taken to suggest that SELDs are beginning to "catch up" in expressive language skills by age four. Still, digit span at age three does not appear to predict this "catching up." The fact that the SELD 3 year olds were poor in both memory and language performance at age three, but function within the normal range by age four could suggest that their delay is due to general maturational lag that affects a variety of cognitive functions, but can be overcome with time.

Results of the PLS-Digit

A significant correlation was found in the normal group for the digit memory recall and the DSS at age 3. No other

significant correlations were found with the PLS-Digit for either the normal or the SELD population.

The correlation found between the PLS-Digit and the DSS given at the same time indicates a relationship, within a normal population, between STM as measured by digit memory recall ability and expressive language development at a given point in time. The two abilities seem to develop in tandem. However, the PLS-Digit does not predict DSS scores one year later. This suggests support for Bloom and Lahey's hypothesis: language and short-term memory are related in development, but short-term memory does not predict and is not a prerequisite for language.

The correlation between digit span and expressive language skill does not hold true for the SELD group. This could suggest that SELD children are less efficient in bringing their STM skill to bear on the task of learning language.

Results of the PLS-Sentence

As with the PLS-Digit, there were few significant correlations with the PLS-Sentence and the dependent variables. A significant correlation was found between the PLS-Sentence and the DSS score from the same year in the NL group. This relationship seems to reflect the same phenomenon as that between the PLS-Digit and DSS-age 3. Short-term memory and language are coordinated at given points in time in normal development. However, STM does not

predict language skills at a later time. The finding that PLS-Sentence and NSST-E are coordinated in the SELD group probably reflects the similarity in the two tasks, both involving sentence repetition.

CHAPTER V

SUMMARY AND IMPLICATIONS

SUMMARY

Although there is agreement in the literature that memory is required for language, there is disagreement as to whether memory ability is a prerequisite for language or if language determines memory ability. The purpose of this study was to determine whether memory skills are related to language development. This question was addressed by looking at differences in memory performance between normal and SELD children, and by examining the correlation between the memory ability of a child at 3 with language ability at 3 and 4.

This study examined the relationship between the PLS-Digit and PLS-Sentence memory tasks and the various expressive and receptive dependent variables. Few significant correlations were found, resulting in a failure to reject the null hypothesis of no relationship between early memory development and later language ability.

The study showed that SELD children do perform more poorly on STM and LTM tasks than do their normally speaking peers. Correlational analysis revealed that the correlations that were significant include the PLS-Digit and

the PLS-Sentence memory recall tasks with the DSS given at the same time for the normal group, and between the PLS-Sentence and NSST-E given at the same time for the SELDs. This indicates a relationship exists between memory and expressive language at the same point in development. Because the relationship exists at the same age, and not across ages, these findings seem to support the theory that language and memory are related in development, but memory skill at one time does not predict language skill at another.

IMPLICATIONS

Clinical Implications

The results of this study indicate that there is insufficient evidence to suggest that memory at age 3 is correlated with language ability at age 4. However, the study does show a correlation between memory and expressive language abilities when tested at the same point in time.

This suggests that testing auditory STM skills in children with language delays will not add new information above what is learned by testing language itself. Testing auditory STM as part of a language assessment would not appear from these data to be an effecient use of the client's time.

As part of language treatment it may be beneficial to teach memory strategies to increase short-term-memory span.

Although spontaneous use of memory strategies do not appear in the preschool child until age 5, Kail (1990) was able to teach mnemonic strategies to 3-year-olds. This would suggest that teaching strategies for increasing short-term-memory in young preschoolers with language delays may improve language learning.

Research Implications

Future research is necessary to better understand the relationship between memory and language development. The present study raises several questions which could be examined in additional studies. These questions include:

1. Are other cognitive abilities besides memory and language affected by the general maturational lag seen in the SELDs, or are these lags specifically auditory, as the SELDs non-verbal cognitive scores on the Draw-a-Person suggest?

2. What is the correlation between memory and receptive language development?

3. What is the relationship between memory and expressive language ability between ages 3 and 4 and does this support the theory that language determines memory?

4. What is the correlation between backward-digit recall and memory development in preschool-aged children?

5. What is the correlation between memory recall ability in a naturalistic, script setting and later language ability?

6. What is the correlation between memory and language in low SES subjects?

7. Would a larger sample size affect the correlation between memory and language?

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APPENDIX A

PARENT CONSENT FORM

COLLEGE OF
LIBERAL ARTS AND SCIENCES

SPEECH AND
HEARING SCIENCES

PORTLAND
STATE
UNIVERSITY

97207
503/229-3531

Dear Parents,

We would like to invite you and your child to participate in a study of language development in toddlers. We hope to learn more about the age range that is normal for the beginning of speech and how children communicate in other ways during the toddler period. If you agree to join the study, you will be asked to bring your child to PSU for testing sessions every 6-12 months. At each session the child will be videotaped playing with you and some toys. We will ask the child to identify some pictures and act out some instructions with toys (such as "Push the car.") In addition we will ask you to answer some questions about the child's social and self-help skills. All parents participating will receive counseling and a list of suggestions for fostering language growth in children under three years of age. The potential benefits of the study are some help for you with stimulating language in your child. In addition, any child who reaches age three and appears to be having problems with language-learning can be referred for services in our clinic or elsewhere.

If you decide not to participate, of course the services you receive from your child's pediatrician, PSU, or any other agency will not be affected. If you decide to join the study you may withdraw at any time.

All results of your child's evaluations will remain strictly confidential. However, if you would like them to be communicated to your pediatrician or anyone else, we will be glad to do so. There will be no charge for any work done with you or your child as part of this study.

If you have any questions, please do not hesitate to ask them, or to call me at 229-3533. Thank you for your help.

Yours,

Rhea Paul, Ph.D., CCC-SPL
Assistant Professor

I (do) (do not) give permission for my child, _____,
to participate in the study described above.

_____ _____
Date Signature

I (do) (do not) give permission to show my child's videotapes for teaching or professional presentations only. I realize full names will not be used in any such presentations.

_____
Signature

APPENDIX B

PRESCHOOL LANGUAGE SCALE

Record Form

Revised Edition

Irla Lee Zimmerman, Violette G. Steiner, & Roberta Evatt Pond

Materials needed to administer test:
Preschool Language Scale manual
Preschool Language Scale picture book
12 1" colored blocks in box (red, yellow, blue, green, orange, purple)
Small piece of coarse sandpaper
Set of coins: half-dollar, quarter, dime, nickel, penny
Watch or clock with second hand

Auditory Comprehension:

Point Score ____ AC Age ____ ACQ ____

Verbal Ability:

Point Score ____ VA Age ____ VAQ ____

Language Age ____ LQ ____

$\frac{AC + VA}{2} = LA$ $\frac{ACQ + VAQ}{2} = LQ$

Name _____

School _____

Teacher _____

Parent or guardian _____

City _____ State _____

Examiner _____

Yr. Mo. Day

Date administered _____

Birthdate _____

Chronological age _____

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8261-7

SECTION III: 2 years to 2 years 6 months

Name _____

Auditory Comprehension

9. Understands the Concept of "One"
   (Twelve blocks.)
   Give me just one.____
   (Must hand examiner only one block.)
10. Compares Size
   (*Picture Book* plate 6, p. 12.)
   Show me the tiny, little spoon.____
   (Points to smaller spoon on first trial.)
11. Understands Use
   (*Picture Book*, plate 7, p. 14.)
   (Same as item 15; administer only once.)
   Show me what: a. we use to comb our hair____, b. we use to drink our milk____, c. goes on our feet____, d. we ride on____, e. we use to iron clothes____, f. we can cut with____, g. we use to sweep the floor____
   (Passes three.)
12. Follows Simple Commands
   (Twelve blocks, box.)
   a. Make a tower like this.____
   b. Now, let's make a train.____
   c. Now, put the blocks in the box.____
   (Passes two.)

Verbal Ability

9. Repeats Two Digits
   Listen: say 2.
   Now say: a. 4–7____, b. 5–8____, c. 3–9____.
   (Passes one.)
10. Names Objects
   (Same as item 6; administer only once.)
   What is that?
   a. shoe____, b. watch____, c. table____,
   d. ball____, e. chair____, f. block____,
   g. pencil____, h. floor____
   (Passes five.)
11. Repeats Sentences
   Can you say, I am a big boy (girl)? a. I like to play in the water____, b. I have a little dog____, c. The dog chases the cat____.
   (Repeats one sentence.)
12. Articulates Consonants I
   (See page 7 in this record form booklet.)
   (Administer all articulation items at same time. Child passes if correctly pronounces consonants in Group I.)

SECTION IV: 2 years 6 months to 3 years

Auditory Comprehension

13. Recognizes Action
   (*Picture Book* plate 8, p. 16.)
   Where is: a. playing____, b. washing____, c. blowing?____
   (Passes two.)
14. Distinguishes Prepositions (One block.)
   (Same as item 22; administer only once.)
   Put the block: a. on the chair____, b. under the chair____, c. in front of the chair____, d. beside the chair____, e. in back of the chair____
   (Passes two.)
15. Understands Use
   (*Picture Book*, plate 7, p. 14.
   Same as item 11; administer only once.)
   Show me what: a. we use to comb our hair____, b. we use to drink our milk____, c. goes on our feet____, d. we ride on____, e. we use to iron clothes____, f. we can cut with____, g. we use to sweep the floor____
   (Passes five.)
16. Distinguishes Parts
   (*Picture Book* plate 9, p. 18.)
   Show me the: a. wheels of the train____, b. door of the car____, c. tail of the horse____, d. nose of the cow____
   (Passes three.)

Verbal Ability

13. Repeats Three Digits
   Listen. Say 4–2.
   Now say: a. 1–4–9____, b. 9–6–1____, c. 2–5–3____.
   (Passes one.)
14. Uses Plurals
   (*Picture Book* plate 10, p. 20.)
   What is this? (a. shoes____, b. blocks____, c. socks____, d. bananas____)
   (Passes two.)
15. Comprehends Physical Needs
   (Same as item 19 and item 23; administer only once.)
   What do you do when you are: a. sleepy?____ b. hungry?____ c. cold?____
   (Passes one.)
16. Converses in Sentences
   Tell me about your pets. (or) Tell me about your toys (sister, baby).
   _____
   _____
   (Uses two or more four- to five-word sentences to answer.)

SECTION V: 3 years to 3 years 6 months

Auditory Comprehension

17. Recognizes Time

Verbal Ability

17. Gives Full Name

(*Picture Book* plate 11, p. 22.)
Which one tells you it is nighttime?____
(Points correctly on first touch.)

18. Compares Length
(*Picture Book* plate 12, p. 24.)
Show me the long one. Put your finger on the long line.
(Six trials, alternating position of plate.)
a. ——— b. ———
c. ——— d. | |
e. ——— f. | |
(Passes three out of the first three or five out of six.)

19. Matches Sets
(Twelve blocks.)
Make yours like mine.
Matches: a. 1____, b. 4____, c. 2____, d. 3____
(Passes three.)

20. Groups Objects
(*Picture Book* plate 13, p. 26.)
Show me: a. all the animals____, b. all the things we eat____, c. all the toys____
(Passes two; points to three in each group.)

What is your name? _____
(Gives full name.)

18. Counts to Three
(Three blocks.)
How many blocks are here? _____
(Realign blocks for second trial.)
Tell me how many is that? _____
(Passes two.)

19. Comprehends Physical Needs
(Same as items 15 and 23; administer only once.)
What do you do when you are: a. sleepy?____ b. hungry?____ c. cold?____ (Passes two.)

20. Articulates Consonants II (See p. 7.)
(Administer all articulation items at same time. Passes if correctly pronounces consonants in Groups I and II.)

SECTION VI: 3 years 6 months to 4 years

Auditory Comprehension

21. Recognizes Colors
(Six colored blocks.)
(Same as item 25; administer only once.)
Show me: a. the RED block____, b. the BLUE block____, c. the YELLOW block____, d. the GREEN block____, e. the ORANGE block____, f. the PURPLE block____
(Passes two; if five, credit item 25.)

22. Distinguishes Prepositions
(One block.)
(Same as item 14; administer only once.)
Put the block: a. on the chair____, b. under the chair____, c. in front of the chair____, d. beside the chair____, e. in back of the chair____
(Passes four.)

23. Differentiates Texture
(Sandpaper and smooth surface.)
a. Which is smoother?____
b. Which is rougher?____
(Passes two.)

24. Understands Action Agents
(*Picture Book* plate 14, p. 28.
Same as item 31; administer only once.)
Show me which one: a. swims in the water____, b. tells time____, c. we write with____, d. we read____, e. we eat at____, f. we put two pieces of wood together with____, g. we cut with____
(Passes five.)

Verbal Ability

21. Repeats Sentences
Can you say *I am a big boy (girl)*?
a. Mary and I feed our little dog every day.____
b. My mother and father went to the store today.____
c. Our mother washes the dishes and sweeps the floor.____
(Passes two.)

22. Knows Opposites
(Same as item 26; administer only once.)
a. Brother is a boy, sister is a . . . ____
b. In daytime it is light, at night it is . . . ____
c. Father is a man, mother is a . . . ____
d. The turtle is slow, the rabbit is . . . ____
e. The sun shines during the day, the moon at . . . ____
(Passes two; if three or more, credit item 26.)

23. Comprehends Physical Needs
(Same as items 15 and 19; administer only once.)
What do you do when you are: a. sleepy?____ b. hungry?____ c. cold?____ (Passes three.)

24. Counts to Ten
Do you know how to count to ten? (or) Let us say 1–2–3 . . . ____
(Counts to ten.)

APPENDIX C

NORTHWESTERN SYNTAX SCREENING TEST

NORTHWESTERN SYNTAX SCREENING TEST
RECORD FORM

Name_____ Sex____ Date_____ B.D._____ C.A._____

Receptive score_____ Percentile_____ Expressive score_____ Percentile_____

Father's occupation_____ Mother's occupation_____

Examiner_____ Testing location_____

Receptive		Expressive	
1. The cat is behind the chair. The cat is under the chair.*		1. The baby is sleeping.* The baby is not sleeping.	
2. She goes upstairs.* He goes upstairs.		2. The dog is on the box. The dog is in the box.*	
3. The cat is on the cupboard. The cat is in the cupboard.*		3. She sees the car.* He sees the car.	
4. The boy is sitting.* The boy is not sitting.		4. The cat is behind the desk. The cat is under the desk.*	
5. The deer is running.* The deer are running.		5. The boy pulls the girl. The girl pulls the boy.*	
6. The boy sees the cat. The boy sees the cats.*		6. The fish is swimming.* The fish are swimming.	
7. The boy sees himself. The boy sees the shelf.*		7. The girl sees the dog. The girl sees the dogs.*	
8. The milk spilled. The milk spills.*		8. This is their wagon.* This is his wagon.	
9. The car hits the train. The train hits the car.*		9. The cats play. The cat plays.*	
10. This is their dog.* This is her dog.		10. Mother says, "Where is that boy?"* Mother says, "Who is that boy?"	
11. This is a mother cat.* This is Mother's cat.		11. The boy washes himself. The boy washes the shelf.*	
12. The girl will drink.* The girl is drinking.		12. This is my dog.* That is my dog.	
13. Mother says, "Look who is here." Mother says, "Look what is here."*		13. The car is in the garage. Is the car in the garage?*	
14. The dog is in the box. Is the dog in the box?*		14. The boy will throw.* The boy is throwing.	
15. The boy writes. The boys write.*		15. The boy jumped. The boy jumps.*	
16. Mother says, "Where is that girl?"* Mother says, "Who is that girl?"		16. Mother says, "Look who I found." Mother says, "Look what I found."*	
17. Has Daddy finished dinner? Daddy has finished dinner.*		17. Has the boy found his ball? The boy has found his ball.*	
18. The boy is pushed by the girl.* The girl is pushed by the boy.		18. This is a baby doll.* This is Baby's doll.	
19. This is my hat.* That is my hat.		19. The boy is pulled by the girl.* The girl is pulled by the boy.	
20. The mother shows the kitty the baby.* The mother shows the baby the kitty.		20. The man brings the girl the boy.* The man brings the boy the girl.	
TOTAL		TOTAL	

Comments:

APPENDIX D

TEST OF AUDITORY COMPREHENSION OF LANGUAGE-REVISED

TACL-R INDIVIDUAL RECORD FORM

Name _____ Sex ☐ M ☐ F

School/Agency _____

City, State _____

Teacher, Dept. _____ Grade _____

Examiner _____

Referral _____

Parent/Guardian _____

Address Street _____

City, State, Zip _____

	YEAR	MONTH	DAY
TEST DATE			
(−) BIRTH DATE			
(=) CHRONOLOGICAL AGE	(×12)+		=
	YEARS	MONTHS	CHRON. AGE IN MONTHS

SCORE SUMMARY	I. WORD CLASSES AND RELATIONS		II. GRAMMATICAL MORPHEMES		III. ELABORATED SENTENCES		IV. TOTAL SCORE (SUM I,II,III RAW SCORES)	
RAW SCORE								
	AGE LEVEL SCORES	GRADE LEVEL SCORES	AGE LEVEL SCORES	GRADE LEVEL SCORES	AGE LEVEL SCORES	GRADE LEVEL SCORES	AGE LEVEL SCORES	GRADE LEVEL SCORES
PERCENTILE RANK								
STANDARD SCORE (SS) Circle One: z T DQ NCE	TABLE 1	TABLE 2	TABLE 1	TABLE 2	TABLE 1	TABLE 2	TABLE 1	TABLE 2
STANDARD ERROR OF MEASUREMENT (SEM)	TABLE 3		TABLE 3		TABLE 3		TABLE 3	
CONFIDENCE INTERVAL (− AND + 1 SEM)	TABLE 4	TABLE 5	TABLE 4	TABLE 5	TABLE 4	TABLE 5	TABLE 4	TABLE 5
AGE EQUIVALENT SCORES (− AND + 1 SEM)	TABLE 6		TABLE 6		TABLE 6		TABLE 6	
INDEX NUMBER (For non-normalized scores only)	APP A	APP B	APP A	APP B	APP A	APP B	APP A	APP B

NOTES

EXAMPLES	RESPONSE	STIMULUS
	NR 1 2 ③	1. baby
	NR 1 ② 3	2. boy
	NR 1 2 ③	3. shoe

BASAL AND CEILING RULES:

BASAL: Four (4) consecutive correct at an age level.

CEILING: Three (3) consecutive incorrect.

Section I. WORD CLASSES AND RELATIONS

SUGGESTED STARTING POINT

	RESPONSE	STIMULUS
3.0—3.5	NR ① 2 3	1. girl
	NR 1 2 ③	2. cat
	NR 1 ② 3	3. bird
	NR ① 2 3	4. box
	NR 1 2 ③	5. jumping
3.6—3.11	NR 1 ② 3	6. cutting
	NR 1 ② 3	7. a bird and a cat
	NR ① 2 3	8. blue
	NR 1 2 ③	9. little
	NR 1 ② 3	10. no eyes
4.0—4.5	NR 1 2 ③	11. together
	NR 1 2 ③	12. a girl jumping
	NR ① 2 3	13. half
	NR ① 2 3	14. up
	NR 1 2 ③	15. cross
4.6—4.11	NR 1 ② 3	16. a large blue ball
	NR 1 ② 3	17. riding a little bicycle
	NR 1 2 ③	18. round
	NR 1 ② 3	19. drawing
	NR ① 2 3	20. eating the fish
5.0—5.11	NR ① 2 3	21. fast
	NR 1 ② 3	22. four
	NR ① 2 3	23. alike
	NR 1 2 ③	24. going
	NR 1 2 ③	25. giving
6.0—6.11	NR ① 2 3	26. some
	NR 1 2 ③	27. many
	NR ① 2 3	28. soft
	NR 1 ② 3	29. most
	NR 1 ② 3	30. letters
7.0—8.11	NR 1 2 ③	31. high
	NR ① 2 3	32. a little bird eating
	NR 1 ② 3	33. second
	NR 1 2 ③	34. collection
	NR ① 2 3	35. pair
9.0—9.11	NR 1 ② 3	36. equal
	NR ① 2 3	37. left
	NR 1 ② 3	38. ascending
	NR 1 2 ③	39. finishing

Section II. GRAMMATICAL MORPHEMES

SUGGESTED STARTING POINT

	RESPONSE	STIMULUS
3.0—3.11	NR ① 2 3	1. The cat is in the box.
	NR 1 ② 3	2. The cap is on the toothpaste.
	NR 1 2 ③	3. The farmer is big.
	NR 1 ② 3	4. The girl is jumping.
	NR 1 ② 3	5. The boy is beside the car.
4.0—4.11	NR ① 2 3	6. The dog is in front of the car.
	NR 1 ② 3	7. The man sees the children play.
	NR 1 2 ③	8. The cat is between the chairs.
	NR 1 ② 3	9. The fish are eating.
	NR 1 ② 3	10. She feeds the birds.
5.0—5.11	NR ① 2 3	11. The ball is under the book.
	NR 1 ② 3	12. The rope is through the box.
	NR 1 ② 3	13. Father said, "I have these."
	NR 1 2 ③	14. She feeds her.
	NR ① 2 3	15. The circle is around the car.
6.0—6.11	NR ① 2 3	16. Show me the shortest man.
	NR 1 2 ③	17. She jumped rope.
	NR 1 ② 3	18. He rode the bicycle.
	NR ① 2 3	19. He feeds himself.
	NR 1 2 ③	20. His dog is big.
7.0—7.11	NR 1 2 ③	21. She is pointing at the pencil.
	NR 1 2 ③	22. The cat drank milk.
	NR 1 ② 3	23. The girl said, "We're eating popcorn."
	NR 1 2 ③	24. The lady said, "This shoe is mine."
	NR 1 ② 3	25. The boy said, "I want this."
8.0—8.11	NR 1 2 ③	26. They swam.
	NR 1 2 ③	27. Mother gave the ball to her.
	NR ① 2 3	28. There is the baby elephant.
	NR 1 2 ③	29. The man painted the house.
	NR ① 2 3	30. The men ran.
9.0—9.11	NR 1 2 ③	31. She sewed the dress.
	NR 1 ② 3	32. The fish swim away.
	NR ① 2 3	33. There is the grandfather's clock.
	NR 1 ② 3	34. Here is the pianist.
	NR ① 2 3	35. She is going to shop.
	NR 1 2 ③	36. The deer eats apples.
	NR ① 2 3	37. The deer is drinking.
	NR ① 2 3	38. She will hit the ball.
	NR 1 2 ③	39. The man has been cutting trees.

Section III. ELABORATED SENTENCES

SUGGESTED STARTING POINT

	RESPONSE	STIMULUS
3.0—4.11	NR 1 2 (3)	1. Who is by the table?
	NR (1) 2 3	2. The man and the boy ate popcorn.
	NR 1 (2) 3	3. The girls are eating and watching TV.
	NR 1 (2) 3	4. It's not round.
	NR 1 (2) 3	5. The man isn't drinking.
5.0—5.11	NR (1) 2 3	6. The mother kisses the baby.
	NR (1) 2 3	7. The boy rode his bicycle home, and his sister went home in the car.
	NR 1 (2) 3	8. It's not a cup.
	NR 1 2 (3)	9. The lady is eating a banana, and the man is drinking milk.
	NR (1) 2 3	10. While the girl saw the movie, she ate some popcorn.
6.0—6.11	NR (1) 2 3	11. She wouldn't ride on the clown's horse.
	NR 1 2 (3)	12. The lady who was standing on the corner by the hamburger stand called to the taxi driver who was driving by.
	NR 1 (2) 3	13. When do you sleep?
	NR 1 2 (3)	14. The boy pushes the girl.
	NR (1) 2 3	15. The boy who was laughing saw the girl.
7.0—7.11	NR 1 2 (3)	16. The boy is chased by the dog.
	NR (1) 2 3	17. She takes the puppy to the boy.
	NR 1 (2) 3	18. After he cut her hair, the hair stylist took a coffee break.
	NR (1) 2 3	19. Mary, her daughter, drank some milk.
	NR 1 2 (3)	20. Before taking the packages to the post office, he had to wrap them.
8.0—8.11	NR (1) 2 3	21. He couldn't reach it although he was tall.
	NR 1 (2) 3	22. The man spoke to the little girl's mother, who was in the car.
	NR (1) 2 3	23. The man said, "Can you reach it?"
	NR 1 2 (3)	24. Besides the baseball glove, she bought a record.
	NR 1 2 (3)	25. With what do you eat?
	NR 1 (2) 3	26. Neither the girl nor the boy is swinging.
	NR (1) 2 3	27. Reading, the boy fell asleep.
	NR 1 2 (3)	28. She shows the girl the boy.
	NR 1 2 (3)	29. She wanted a blouse, however, she got a skirt.
	NR (1) 2 3	30. Mother said, "Is it raining?"
9.0—9.11	NR 1 (2) 3	31. Having put her coat in the closet, she took off her shoes.
	NR 1 (2) 3	32. If her mother had baked a cake, the girl would have gone to the party.
	NR 1 2 (3)	33. Before she jumped in the pool, the girl waved to her mother.
	NR 1 (2) 3	34. The boy the dog watched was eating.
	NR 1 (2) 3	35. The boy called the girl with the baseball cap.
	NR 1 2 (3)	36. The girl asked her father to throw her the ball, but he didn't.
	NR 1 (2) 3	37. Had it been possible, he would have ridden in the car or on the bicycle.
	NR (1) 2 3	38. The baby the woman held clapped her hands.
	NR 1 2 (3)	39. The boy the girl pulled had on a baseball cap.
	NR (1) 2 3	40. The policeman the waitress with the white cap served was holding some coffee.

STANDARD SCORE PROFILE — AGE LEVEL NORMS *(Plot Standard Score + and − Standard Error of Measurement.)*

Circle One.												
Z SCORE	− 5.0	− 4.0	− 3.0	− 2.0	− 1.0	.00	+ 1.0	+ 2.0	+ 3.0	+ 4.0	+ 5.0	
T SCORE	0	10	20	30	40	50	60	70	80	90	100	
DEVIATION QUOTIENT	25	40	55	70	85	100	115	130	145	160	175	
NORMAL CURVE EQUIVALENT	−55	−34	−13	+ 8	+29	+ 50	+ 71	+ 92	+113	+134	+155	

I. WORD CLASSES AND RELATIONS

II GRAMMATICAL MORPHEMES

III ELABORATED SENTENCES

IV TOTAL SCORE

Normalized data unless indicated in Summary Score

STANDARD SCORE PROFILE — GRADE LEVEL NORMS *(Plot Standard Score + and − Standard Error of Measurement.)*

Circle One:												
Z SCORE	− 5.0	− 4.0	− 3.0	− 2.0	− 1.0	.00	+ 1.0	+ 2.0	+ 3.0	+ 4.0	+ 5.0	
T SCORE	0	10	20	30	40	50	60	70	80	90	100	
DEVIATION QUOTIENT	25	40	55	70	85	100	115	130	145	160	175	
NORMAL CURVE EQUIVALENT	−55	−34	−13	+ 8	+29	+ 50	+ 71	+ 92	+113	+134	+155	

I. WORD CLASSES AND RELATIONS

II GRAMMATICAL MORPHEMES

III ELABORATED SENTENCES

IV TOTAL SCORE

Normalized data unless indicated in Summary Score

AGE EQUIVALENT SCORE PROFILE

MONTHS	24	30	36	42	48	54	60	66	72	84	96	108	120
YEARS	2-0	2-6	3-0	3-6	4-0	4-6	5-0	5-6	6-0	7-0	8-0	9-0	10

I WORD CLASSES AND RELATIONS

II GRAMMATICAL MORPHEMES

III ELABORATED SENTENCES

APPENDIX E

DEVELOPMENTAL SENTENCE SCORING

Patient's Name _____

Birth Date_____

Recording Date_____

CA:

DSS = Total Score / # of utterances (50)

Sentence #	Indef. Pro.	Pers. Pro.	Main Verb	Sec. Verb	Neg.	Conj.	Inter. Rev.	Wh-Q	Sent. Pt.	Total
1.										
2.										
3.										
4.										
5.										
6.										
7.										
8.										
9.										
10.										
11.										
12.										
13.										
14.										
15.										
16.										
17.										
18.										
19.										
20.										
21.										
22.										
23.										
24.										
25.										

APPENDIX F

TEST OF LANGUAGE DEVELOPMENT- PRIMARY

TOLD-P

TEST OF LANGUAGE DEVELOPMENT PRIMARY

Phyllis L. Newcomer & Donald D. Hammill

Name _____ Female ☐ Male ☐

	Year	Month	Day
Date Tested			
Date of Birth			
Age			

School: _____ Grade: _____

Examiner's Name: _____ (FIRST) (LAST)

Examiners' Title: _____

SECTION I RECORD OF SCORES

SUBTESTS:

		Raw Scores	Ages	%iles	Standard Scores
I	Picture Vocabulary				
II	Oral Vocabulary				
III	Gram. Understanding				
IV	Sentence Imitation				
V	Gram. Completion				
VI	Word Discrimination				
VII	Word Articulation				

COMPOSITES:

	PV	OV	GU	SI	GC	= Sum of Std. Scores	Quotients
Spoken Language (SLQ)	☐	☐	☐	☐	☐	= ☐	( )
Listening (LiQ)	☐		☐			= ☐	( )
Speaking (SpQ)		☐		☐	☐	= ☐	( )
Semantics (SeQ)	☐	☐				= ☐	( )
Syntax (SyQ)			☐	☐	☐	= ☐	( )

SECTION II TOLD-P PROFILE:

Quotients	Conceptual Abilities	SLQ	Quotients	Listening (LiQ)	Speaking (SpQ)	Semantics (SeQ)	Syntax (SyQ)	Standard Scores	Picture Vocabulary	Oral Vocabulary	Grammatic Understanding	Sentence Imitation	Grammatic Completion	Word Discrimination	Word Articulation	Standard Scores
150	•	•	150	•	•	•	•	20	•	•	•	•	•	•	•	20
145	•	•	145	•	•	•	•	19	•	•	•	•	•	•	•	19
140	•	•	140	•	•	•	•	18	•	•	•	•	•	•	•	18
135	•	•	135	•	•	•	•	17	•	•	•	•	•	•	•	17
130	•	•	130	•	•	•	•	16	•	•	•	•	•	•	•	16
125	•	•	125	•	•	•	•	15	•	•	•	•	•	•	•	15
120	•	•	120	•	•	•	•	14	•	•	•	•	•	•	•	14
115	•	•	115	•	•	•	•	13	•	•	•	•	•	•	•	13
110	•	•	110	•	•	•	•	12	•	•	•	•	•	•	•	12
105	•	•	105	•	•	•	•	11	•	•	•	•	•	•	•	11
100	—	—	100	—	—	—	—	10	—	—	—	—	—	—	—	10
95	•	•	95	•	•	•	•	9	•	•	•	•	•	•	•	9
90	•	•	90	•	•	•	•	8	•	•	•	•	•	•	•	8
85	•	•	85	•	•	•	•	7	•	•	•	•	•	•	•	7
80	•	•	80	•	•	•	•	6	•	•	•	•	•	•	•	6
75	•	•	75	•	•	•	•	5	•	•	•	•	•	•	•	5
70	•	•	70	•	•	•	•	4	•	•	•	•	•	•	•	4
65	•	•	65	•	•	•	•	3	•	•	•	•	•	•	•	3
60	•	•	60	•	•	•	•	2	•	•	•	•	•	•	•	2
55	•	•	55	•	•	•	•	1	•	•	•	•	•	•	•	1

SECTION III NOTES:

PICTURE VOCABULARY		Score 1 or 0	Discontinue after 5 consecutive failures		Score 1 or 0
1. mirror	A		16. emigrant	C	1
2. bulb	A		17. vine	A	
3. tray	A		18. monument	B	
4. farmer	D		19. herd	C	
5. anchor	A		20. novel	B	
6. explosive	B		21. feeble	D	
7. lizard	B		22. dome	D	
8. winged	A		23. floral	B	
9. stump	B		24. maternal	A	
10. medical	B		25. infantry	D	
11. young	C				
12. voyage	B				
13. weep	C				
14. salmon	A				
15. oil	A				

No. of 1s _____
No. of 0s _____
Total ____ (25) ____

ORAL VOCABULARY	Discontinue after 5 consecutive failures	Score 1 or 0
1. bird		1
2. rest		2
3. face		3
4. door		4
5. cow		5
6. finger		6
7. ocean		7
8. sugar		8
9. forest		9
10. baby		10
11. poor		11
12. sad		12
13. season		13
14. castle		14
15. old		15
16. true		16
17. behind		17
18. village		18
19. tall		19
20. north		20

No. of 1s _____

GRAMMATIC UNDERSTANDING		Score 1 or 0
1. She went quickly.	A	
2. She wondered why they didn't like her.	B	
3. They are different.	C	
4. She stood between them.	A	
5. They haven't finished eating.	A	
6. He did not understand what she was saying.	B	
7. She sat in the middle.	C	
8. The boy has been waiting a long time for his friends to arrive.	A	
9. The children's boots are here.	C	
10. Few were there.	A	
11. She has fallen and broken her leg.	C	
12. The picture that was drawn by the artist is finished.	C	
13. He was not the dog she was looking for.	C	
14. As he had already finished his work, he was not kept after school.	A	

Discontinue after 5 consecutive failures		Score 1 or 0
15. It goes up.	C	
16. Having heard the evidence, the judge sentenced him.	C	
17. He is going to pitch.	A	
18. Neither the giraffe nor the lion is running.	C	
19. He had ridden.	C	
20. The boy who is wearing the checkered sweater is the winner.	C	
21. The paper had been delivered.	A	
22. The dog belonged to the other boy.	A	
23. The bad boy had eaten it all.	C	
24. He is the one to do the final problem.	B	
25. The bicycle had been stolen.	C	

No. of 1s _____
No. of 0s _____
Total ____ (25) ____

SENTENCE IMITATION — Discontinue after 5 consecutive failures	Score 1 or 0
1. Her friends walked to school.	1
2. My new kitten is spotted.	2
3. After the party, the boys fixed the car.	3
4. Yesterday my aunt forgot her lunch.	4
5. Because he was tired, he had to leave the party.	5
6. Have the people been helped by the king?	6
7. Weren't the boys chased by the policeman?	7
8. Those ladies aren't baking cakes.	8
9. She didn't believe he liked her.	9
10. Before bed we drink from our special cups.	10
11. Here is a picture that you should see.	11
12. In the afternoon, there is no one home from school.	12
13. There are no children allowed, are there?	13
14. Our dog chased a cat a mile, didn't he?	14
15. Monkeys don't eat bananas by the dozen, do they?	15
16. Those children sold two friends a bicycle.	16
17. If you need money, you must earn it at your job.	17
18. Because he misbehaved, his father gave him a beating.	18
19. Although we are happy, we are not going to stay.	19
20. Weren't the children taken to the zoo by their teacher?	20
21. Last week, I sold Mrs. Thomas my best bicycle.	21
22. Although she won't play with him, he likes her.	22
23. Although you don't believe me, there's a good program on television.	23
24. Are those cats being given a bath by their owner?	24
25. The car which was in the accident was wrecked.	25
26. The train which hit the car fell from the tracks.	26
27. Yesterday, we were saved form the clutches of an angry teacher.	27
28. I would have been happy, if I'd have won.	28
29. The fun-loving children played a silly joke a day.	29
30. They gave the lion who had become very dangerous to the zoo.	30

GRAMMATIC COMPLETION — Discontinue after 5 consecutive failures	Score 1 or 0	
1. Mary has a dress and Joan has a dress. They have two (dresses). _____	_____	1.
2. Joey likes to play. Right now he is (playing). _____	_____	2.
3. The shoes belong to the boy. Whose shoes are they? They are the (boy's). _____	_____	3.
4. Betty likes to swim everyday. Today she is (swimming). _____	_____	4.
5. A lady likes to drive. Everyday she (drives). _____	_____	5.
6. A boy likes to ride his bicycle everyday. Today he is (riding). _____	_____	6.
7. The toys belong to the children. Whose toys are they? They are the (children's). _____	_____	7.
8. A girl plays the piano everyday. Yesterday she (played). _____	_____	8.
9. The hat belongs to mother. Whose hat is it? It is (mother's). _____	_____	9.
10. The dress belongs to the woman. Whose dress is it? It is the (woman's). _____	_____	10.
11. A person who sings is a (singer). _____	_____	11.
12. Betty likes to eat cookies. Everyday she (eats). _____	_____	12.
13. John likes to cook everyday. Yesterday he (cooked). _____	_____	13.
14. Jane likes to jump. Now she is (jumping). _____	_____	14.
15. A cake might be small, but a cupcake is (smaller). _____	_____	15.
16. A person who paints fences is a (painter). _____	_____	16.
17. A dog can be big, but a horse is (bigger). _____	_____	17.
18. A person who plays a drum is a (drummer). _____	_____	18.
19. Joe had a gumdrop, and Sue had a handful of gumdrops; but Tom had a bagfull so he had the (most). _____	_____	19.
20. Bob is a man. Bill is a man. Bob and Bill are two (men). _____	_____	20.
21. A cake might be small, and a cupcake smaller, but a cookie is the (smallest). _____	_____	21.
22. John likes to throw the ball everyday. Yesterday he (threw). _____	_____	22.
23. Today I found a leaf. Yesterday I found two (leaves). _____	_____	23.
24. A boy likes to ride his bicycle everyday. Yesterday he (rode). _____	_____	24.
25. A spoonful of ice cream is good, two spoonfuls are better, and a dishful is (best). _____	_____	25.
26. Joe had one gumdrop. Sue had a handful of gumdrops, so she had (more). _____	_____	26.
27. Mary is a woman. Joan is a woman. Mary and Joan are two (women). _____	_____	27.
28. Betty likes to draw everyday. Yesterday she (drew). _____	_____	28.
29. I have a mouse. She has a mouse. We have two (mice). _____	_____	29.
30. Jeff ate the candy quickly; and when Bill came, it had all been (eaten). _____	_____	30.

No. of 1s _____
No. of 0s _____
Total ____ (30) ____

WORD DISCRIMINATION	Score 1 or 0	Foils
1. red-dead	_____	
2. bed-bread	_____	
a. (chair-chair)		a. _____
3. pig-big	_____	
4. sat-sad	_____	
b. (work-work)		b. _____
5. vale-dale	_____	
6. chop-shop	_____	
7. rub-rug	_____	
c. (face-face)		c. _____
8. roped-robed	_____	
9. refracted-retracted	_____	
d. (cry-cry)		d. _____
10. cash-catch	_____	
e. (never-never)		e. _____
11. fresh-flesh	_____	
12. watch-wash	_____	
13. vest-vexed	_____	
14. defection-deflection	_____	
15. weak-weep	_____	
f. (stop-stop)		f. _____
16. falls-false	_____	
17. leave-leaf	_____	
18. win-when	_____	
19. madder-matter	_____	
20. conical-comical	_____	Foils

WORD ARTICULATION	Score 1 or 0
1. tree	
2. soap	
3. dishes	
4. skate	
5. bridge	
6. whistle	
7. bicycle	
8. ring	
9. basket	
10. zebra	
11. scissors	
12. judge	
13. garage	
14. zipper	
15. razor	
16. feather	
17. soldier	
18. thread	
19. treasure	
20. birthday	

APPENDIX G

SUBJECT DATA

DATA FOR THE DEPENDENT VARIABLES FROM THE SELD GROUP

Subject	PLS*		NSST*	TACL*	DSS		TOLD	
	D	S			'88	'89	L	S
6	3	1	0	9	3.74	6.36	20	37
7	1	0	0	17	2.82	6.44	25	33
29	4	0	0	29	.43	4.24	27	28
53	6	0	0	31	6.12	8.18	22	43
54	0	0	1	36	3.4	5.63	14	34
57	2	3	4	33	4.97	8.18	32	36
85	3	1	0	15	2.72	5.70	15	33
87	6	1	6	27	4.48	7.90	41	45
92	3	0	0	77	5.48	4.10	34	39
102	1	0	0	20	4.05	8.08	23	36
105	0	0	0	39	4.80	6.68	38	49
114	4	1	0	36	2.05	6.67	23	37
115	4	0	1	14	2.81	5.77	12	26
119	5	4	18	34	4.66	5.26	18	44
X:	3	.786	2	30	3.75	6.37	25	37

*PLS, NSST and TACL are raw scores.
DSS and TOLD are standard scores.

DATA FOR THE DEPENDENT VARIABLES FROM THE NORMAL GROUP

Subject	PLS		NSST-E	TACL	DSS		TOLD	
	D	S			'88	'89	L	S
14	5	1	2	29	2.72	4.07	33	36
51	5	1	2	29	2.72	4.07	33	36
55	5	4	14	41	4.72	5.66	33	36
58	5	4	8	35	8.16	7.92	38	44
63	5	3	3	38	5.22	6.33	27	50
72	4	3	15	23	4.62	6.70	24	38
95	6	4	0	22	5.72	5.50	20	42
128	6	4	20	43	7.40	5.58	32	53
130	6	2	1	43	4.80	8.62	38	47
131	5	4	12	37	4.48	8.08	39	42
132	6	3	0	37	5.51	8.04	34	36
133	6	4	20	36	6.46	8.34	21	38
144	2	4	13	36	5.56	6.14	37	51
150	6	3	21	63	7.82	6.70	38	41
X:	5	3	9	37	5.42	6.55	32	42