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I. INTRODUCTION

The syntactic development of both oral and written language in hearing impaired children has been the focus of extensive research in the past and remains a major field of investigation for professionals involved with hearing-impaired children. As several studies have proven in past years, the oral language development of hearing-impaired children is severely delayed in comparison to that of normal hearing children. According to a study by Marilya and Mignone (1977) that investigated the oral development of three deaf children from birth to five years of age, the deaf children paralleled normal hearing children in language development until approximately the age of two years but fell dramatically behind from that age on. Quigley (1984) observed that "the primary language development of hearing-impaired children was similar in sequence but slower in rate to that of hearing children."

The written language of hearing-impaired children is used, along with reading ability, as a major indicator of language development and progress in hearing-impaired children over ten years of age (Quigley, 1984). Numerous studies have investigated the written language of hearing-impaired children, but only a few selected studies will be reviewed here.

As early as the 1940's, Heider and Heider analyzed compositions describing a short film by hearing-impaired students, eleven to seventeen years of age and hearing students from eight

to fourteen years of age. Results indicated relatively rigid, immature and simple written patterns by the deaf students. Heider and Heider also found that hearing-impaired children did not attain the average sentence length of eight year old hearing children until they were seventeen years old.

Almost twenty years later, Myklebust (1964) developed a "syntax score" to measure written language. Using the syntax score, he compared hearing-impaired fifteen year olds with hearing seven year olds and reported statistically significant differences at every level in favor of the hearing children. The mean score for seven year old hearing children of 86.8 was similar to that of fifteen year old hearing-impaired children at 86.2. From this, Myklebust concluded that "the structure of written language conforms closely to the spoken form and that maturity in the syntax of written English is based upon previously developed maturity in spoken language." (Moores, 1978)

Data from Lee's research were included in a study on syntactic maturity by Geers and Moog (1978). In the normative sample of two hundred children, Lee presented the average developmental sentence score for each age group, as well as the number of entries in each grammatical category. Geers and Moog compared a hearing-impaired group's sentence scores to Lee's normative group scores. The two groups differed in the manner in which the overall scores were obtained. First, the children in the hearing impaired sample used more developmentally advanced structures than

the children in the normative sample. Therefore, the hearing-impaired group received higher ratings. (Table 5).

Secondly, the hearing normative group had more entries per category than did the hearing-impaired group. Children in the normative sample used more indefinite pronouns, personal pronouns, primary verbs, secondary verbs and negatives while children in the hearing-impaired sample averaged more entries per category in only three categories; conjunctions, interrogative reversals and WH-questions. The hearing-impaired group also produced fewer grammatically correct sentences. In short, the hearing-impaired subjects tended to use more mature constructions in all grammatical categories, but produced fewer correct structures per utterance than hearing children.

Finally, Quigley, in Language and Deafness, cites Cooper and Rosenstein's (1966) conclusion that "deaf children have been found to be markedly retarded in their scholastic achievement test scores. Their written language, compared to that of hearing children, was found to contain shorter and simpler sentences, to display a somewhat different distribution of the parts of speech, to appear more rigid and more stereotyped and to exhibit numerous errors or departures from Standard English use." (Quigley, 1984).

The purpose of the study was to investigate both the oral and written syntactic development of profoundly deaf adolescents. The Developmental Sentence Analysis method for making a quantified and scored evaluation of a child's use of Standard English was used

to evaluate fifty oral and written utterances generated by the subjects in the study. The oral and written Developmental Sentence Analysis scores were then correlated with subjects standardized reading and syntactic ability scores, along with their speech frequency averages to investigate if any relationship existed between the variables and what possible conclusions could be derived from that information.

Hypothesis 1: There exists a significant positive relationship between the syntactic complexity of the deaf child's oral and written language.

Hypothesis 2: Hearing-impaired children with more syntactically mature oral and written language will exhibit greater reading comprehension.

II. SUBJECTS

The population for this study consisted of eleven profoundly deaf adolescents, five boys and six girls, ages seventeen and eighteen years old. The subjects' hearing levels or speech frequency averages (S.F.A.) at 500, 1000 and 2000 Hz in the better ear ranged from 92dB to 122dB, with a mean speech frequency average of 103.2dB. All but two of the subjects were enrolled in mainstreamed settings within public, normal-hearing high schools. All data on the subjects were collected in June and July of 1985 as a part of a reading research project held at Central Institute for the Deaf.

To assess reading ability, the Stanford Achievement Test - Paragraph Comprehension Subtest was administered to all eleven subjects. The Stanford Achievement test yields a grade-equivelent score, and the mean grade score for this population was 6.4, a standard deviatin of 4.20, and a range in scores from 2.4 to 13.0. (Table 1).

The Test of Syntactic Ability Screening (T.S.A.) was also administered to all the subjects. The Test of Syntactic Ability is comprised of recognition tasks that require the subject to recognise and indicate a syntactically incorrect sentence. The test evaluates nine areas; negation, conjunction, determiners, question formations, verb processes, pronominalization, relativization, complementation and nominalization. The T.S.A. yields a

percentage correct score for each of the nine areas evaluated, as well as an average percent correct score. The subjects' average correct percentage score ranged from 44% to 100% with a mean T.S.A. score of 85.9 and a standard deviation of 16.29. (Table 1).

The Developmental Sentence Analysis (D.S.A.), developed by Laura Lee (1974) was used to score and evaluate the oral and written language samples generated by the subjects. The D.S.A. provides an empirical measure of syntactic development in spoken language. It was developed to illustrate the general order in which children with normal hearing begin to use particular grammatical structures in their spontaneous speech. The structures developed at an early age earn fewer points than those developed later on. Only complete utterances containing both a subject and verb are scored. Each subject is given a score in each of eight grammatical categories; indefinite pronouns, personal pronouns, main verbs, secondary verbs, negatives, conjuctions, interrogative reversals and WH-questions, as well as a sentence point for each correct, complete sentence and a total score.

III. METHOD

The method of collection for the spontaneous oral language samples was a procedure in which an examiner engaged the subject in a conversation, prompting responses by asking questions over a wide variety of topics - family, school life activities, hobbies, vacations, etc. The entire conversation was vidiotaped and, afterwards, the examiner replayed the tape and transcribed one hundred utterances for each subject. The next step involved the scoring of the second half, utterances 50-100, using the Developmental Sentence Analysis (D.S.A.), developed by Laura Lee (1974). The D.S.A. total scores on the oral language samples ranged from 5.38 to 16.82 with a mean oral score of 10.42 and a standard deviation of 4.12. (Table 1).

The same scoring procedure and format was utilized in the scoring of the written language samples. Again, only complete sentences were scored using the D.S.A. procedure. The stimuli used to elicit the written samples included tasks that required the subject to write a letter in which he ordered a poster; a letter notifying a mailorder company that a bill received was incorrect; a persuasive letter; a short report about an interesting vacation and a report on a historical figure the subject would like to meet. Whereas fifty utterances were scored in the oral language sample, none of the subjects wrote fifty complete sentences in the written task. The number of complete written sentences over

all five tasks ranged from a low of fourteen to a high of forty-two. The D.S.A. scores for the written language samples ranged from 6.07 to 18.05 with a mean score of 13.0 and a standard deviation of 3.77. (Table 1).

IV. RESULTS

The results of these subject's oral and written language samples yield some interesting information when compared to hearing childrens' D.S.A. scores. First, all the subjects in this study were considered adults chronologically but in relation to syntactic development and maturity, they were compared to normal-hearing six year olds. A normal-hearing child has developed all the basic syntactical structures of his language by age six and conversely, a hearing-impaired seventeen or eighteen year old adolescent has also developed all of the major syntactic structures that he/she is able to use in spoken and written language. In other words, both the young hearing child and the older hearing-impaired adolescent are "syntactic adults," but have reached that stage at very different ages, as well as, levels of complexity.

Lee, in her book Developmental Sentence Analysis (1974), provides D.S.A. mean scores, ranges and percentiles for two hundred hearing subjects, in one-year age groups. (Table 2). From the mean D.S.A. score of 10.42 for the subjects in this study, it is clear that the subjects fall into the 50th percentile for hearing children. That is to say that 50% of the hearing-impaired adolescents in this study scored below the six year old children in Lee's statistics. These statistics suggest that the hearing-impaired subjects syntactic development is delayed.

However, since Lee does not provide data for older children, the normal developmental progression of D.S.S. scores is unknown.

The most significant results appear when statistical correlations were performed on the Stanford Paragraph Comprehension scores, the Test of Syntactic Ability scores, the D.S.A. scores and the speech frequency averages. As Table 4 indicates, the D.S.A. scores for the oral language samples have a high correlation (0.81) with the Stanford Paragraph Comprehension subtest scores. The oral D.S.A. scores also correlate well with the overall T.S.A. scores at 0.69. A high correlation was found to exist between the oral and written D.S.A. scores: 0.85. Somewhat surprising was the almost nonexistent and negative correlation between the speech frequency averages and the oral D.S.A. score at -0.07.

In regard to the D.S.A. scores for the written language samples, the correlation between the D.S.A. written scores and the Stanford Paragraph Comprehension subtest was 0.72, which is relatively high. An even higher correlation existed between the written D.S.A. scores and the T.S.A.: 0.91. As with the oral D.S.A. scores, there was virtually no statistical relationship between the speech frequency averages and the written D.S.A.s: -0.04.

V. CONCLUSION

This study and it's results lead to several interesting and significant conclusions. As is evident by the grade-equivelent scores on the Stanford Paragraph Comprehension subtest, the subjects in this study cover a wide range of reading ability. The subjects also vary to a great extent in their syntactic maturity and complexity as evidenced by the variety of scores on the Test of Syntactic Ability.

Equally important is the fact that the mean scores on both the oral and written samples of the D.S.A. indicate that this group does not exhibit a wide nor significant gap between their oral and written language skills and abilities. This lack of a gap between the subjects' oral and written D.S.A. scores is depicted in Graph 1. This information is somewhat surprising due to the fact that most people use more complex grammatical structures in written tasks as opposed to everyday natural conversation. In other words, the majority of people write in a higher level language than they use to speak. However, for the group of subjects in this study, that phenomenon does not exist. These hearing-impaired adolescents write and speak at comparable syntactic levels.

Another conclusion can be drawn from the fact that both the D.S.A. scores for the oral and written language samples have a high correlation with the reading scores. This indicates that

hearing-impaired children who possess better than average reading skills tend to possess good oral and written language skills. The reverse is also true. Poor or below average hearing-impaired readers often possess less competent oral and written language skills. These conclusions are supported by the data in Table 1; subjects with low scores in one test area tend to have low scores across the board and vice versa.

Finally, it is evident that hearing sensitivity has literally no influence on these subjects' oral and written language skills. The negative correlations of -0.07 and -0.04 indicate that the degree of hearing loss in such a profound range has no effect on a subject's ability to generate and utilize high level syntactic structures.

In conclusion, the results of this study do have implications in regard to the importance of teaching English syntax to deaf children. First, hearing children learn correct syntax simply by hearing it in everyday conversation. Deaf children, however, only learn proper syntactical structure in a highly structured teaching environment. Secondly, if it is true that hearing-impaired children who possess better than average reading skills tend to possess good oral and written language skills, then it is crucial that a concentrated and intense effort be made to improve hearing-impaired childrens' reading skills and abilities so to bring them up to or, at least, close to the level of hearing children of the same age.

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TABLE #1

Individual Overall Scores, Means and Standard Deviations

Subject	D.S.S. Oral-Total	D.S.S. Written-Total	Stanford Comprehension	T.S.A.	S.F.A.
#1	5.38	9.75	3.2	76	110
#2	16.82	18.05	13.0	96	100
#3	5.66	6.07	2.4	44	95
#4	9.32	15.93	3.8	98	95
#5	7.06	8.32	3.4	76	98
#6	9.04	12.18	6.7	86	122
#7	7.52	12.26	3.8	85	110
#8	15.14	15.80	13.0	98	118
#9	14.82	16.95	12.0	100	92
#10	9.58	14.04	5.7	95	98
#11	14.38	14.50	3.4	91	98
Mean	10.42	13.0	6.4	85.9	103.2
Standard Deviation	4.12	3.77	4.20	16.29	10.08

TABLE #2

DSS Means and Standard Deviations of 200 Subjects by One-Year Age Groups

Age Group	N	Mean DSS	Standard Deviation
2-0 to 2-11	40	3.73	1.28
3-0 to 3-11	40	6.64	1.00
4-0 to 4-11	40	8.04	1.64
5-0 to 5-11	40	9.19	1.90
6-0 to 6-11	40	10.94	2.26

TABLE #3

Range and Percentiles of DSS Scores for 200

Subjects by One-Year Age Groups

Age Group	N	Range	Percentiles				
			10th	25th	50th	75th	90th
2-0 to 2-11	40	1.50 - 6.70	2.30	2.98	3.73	4.48	5.16
3-0 to 3-11	40	4.60 - 8.60	5.38	5.98	6.64	7.30	7.89
4-0 to 4-11	40	4.86 - 12.94	6.01	6.97	8.04	9.10	10.06
5-0 to 5-11	40	6.04 - 13.40	6.72	7.89	9.19	10.49	11.66
6-0 to 6-11	40	6.64 - 15.84	8.11	9.43	10.94	12.43	13.78

TABLE #4

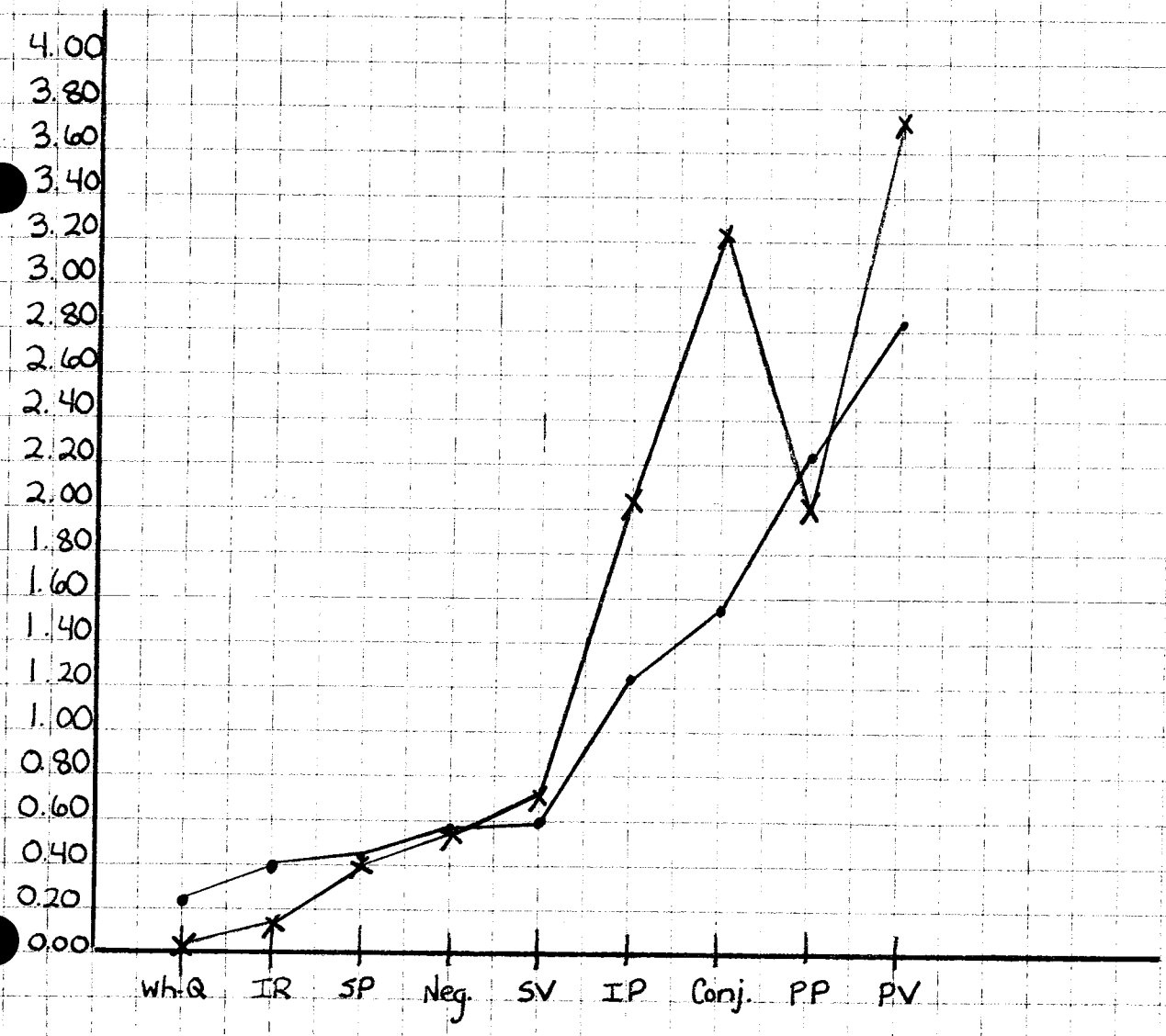
Statistical Correlations

	Stanford Comprehension	T.S.A.	D.S.S.-Oral	D.S.S.-Written	S.F.A.
D.S.S. - Oral	0.81	0.69	—	0.85	-0.07
D.S.S. - Written	0.72	0.91	0.85	—	-0.04

TABLE 5. Mean developmental sentence score and number of entries per grammatical category for deaf subjects and normals from the normative sample.

		Indefinite Pronoun	Personal Pronoun	Primary Verb	Secondary Verb	Negative	Conjunction	Inter-rogative Reversal	wh-question
Developmental sentence score per category	Deaf	2.31	1.96	2.13	3.74	4.67	3.95	3.32	2.06
	Normals	2.07	1.65	1.94	3.03	4.65	3.32	1.90	1.62
Number of entries per category	Deaf	19.73	45.33	50.86	5.18	3.00	13.13	2.67	2.06
	Normals	28.91	47.91	55.20	7.29	3.68	11.98	1.44	1.90

Graph #1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3.60
3.40
3.20
3.00
2.80
2.60
2.40
2.20
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
wh-Q
IR
SP
Neg.
SV
IP
Conj.
PP
PV
mean oral DSA score
mean written DSA score

Developmental Sentence Analysis Scores - by Categories
Oral Sample

Subject #s

	I.P.	P.P.	P.V.	S.V.	Neg.	Conj.	I.R.	Wh-Q	S.P.	Total
#1	0.66	1.68	1.72	0.06	0.18	0.48	0.14	0.28	0.18	5.38
#2	1.80	3.78	4.82	0.98	0.70	3.46	0.42	0.38	0.50	16.82
#3	0.44	1.20	2.40	0.00	0.56	0.68	0.00	0.04	0.32	5.66
#4	1.28	2.12	2.56	0.64	0.52	0.72	0.56	0.12	0.64	9.32
#5	0.50	1.08	2.12	0.00	0.86	0.84	0.78	0.56	0.36	7.06
#6	1.42	1.80	2.80	0.12	0.54	1.32	0.36	0.12	0.44	9.04
#7	1.08	1.88	1.84	0.30	0.98	0.26	0.38	0.40	0.40	7.52
#8	2.42	3.14	3.74	1.64	0.40	2.44	0.60	0.06	0.58	15.14
#9	1.42	3.28	4.06	1.86	0.72	2.38	0.14	0.28	0.70	14.82
#10	0.74	2.28	3.50	0.38	0.34	1.50	0.28	0.38	0.56	9.58
#11	2.06	3.22	3.78	0.72	0.64	2.64	0.74	0.18	0.42	14.38
mean score	1.25	2.31	3.03	0.60	0.58	1.52	0.40	0.25	0.46	10.42

Developmental Sentence Analysis Scores - by Categories
Written Sample

Subject #5

	I.P.	P.P.	P.V.	S.V.	Neg.	Conj.	I.R.	Wh-Q	S.P.	Total
#1	2.66	1.04	3.58	0.12	0.54	1.12	0.25	0.00	0.41	9.75
#2	2.81	2.27	5.40	0.64	0.75	5.45	0.00	0.00	0.67	18.05
#3	1.42	1.35	1.35	0.42	0.57	0.85	0.00	0.00	0.07	6.07
#4	3.12	2.21	3.42	1.78	0.75	4.12	0.18	0.00	0.42	15.93
#5	1.57	0.92	2.53	0.32	0.60	1.53	0.21	0.42	0.50	8.32
#6	1.86	2.51	3.67	0.94	0.59	2.32	0.02	0.00	0.27	12.18
#7	1.78	3.05	3.68	0.63	0.21	2.63	0.00	0.00	0.26	12.26
#8	1.22	1.70	4.70	0.77	0.48	6.16	0.00	0.00	0.70	15.80
#9	2.35	2.45	4.97	1.04	0.71	4.57	0.07	0.00	0.71	16.95
#10	2.91	2.33	4.00	0.70	0.00	3.25	0.00	0.29	0.54	14.04
#11	1.27	2.27	4.22	0.50	1.00	4.38	0.66	0.00	0.16	14.50
mean score	2.08	2.00	3.77	0.71	0.56	3.30	0.12	0.06	0.42	13.07