

PSYCHOLINGUISTIC IMPLICATIONS OF DEAFNESS: A REVIEW

by

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PSYCHOLINGUISTIC IMPLICATIONS OF DEAFNESS: A REVIEW*

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1. Introduction and Historical Background

Vernon (1968a) outlined the changes in the etiology of deafness during the past half-century. In the past, a large proportion of the deaf population lost their hearing as a result of scarlet fever, meningitis, polio, mastoiditis, ear infections, and other adventitious conditions; now, only a small fraction of the deaf lose their hearing as a result of diseases or accidents in childhood. Within the last fifty years, this reduction has been particularly pronounced: About 95 percent of the deaf children now living lost their hearing prelingually; earlier in this century, approximately two thirds of the deaf lost their hearing prelingually. This major change in the incidence of deafness might correspond with a change in the deaf child's performance capabilities and necessitate a transformation in the methods of educating the deaf.

The first permanent school for the deaf in America was opened in Hartford, Connecticut in 1817, under the direction of Thomas Hopkins

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Gallaudet. Abernathy (1959) noted that Gallaudet first visited Great Britain to learn of methods for educating the deaf, but because of the secretive and monopolizing spirit prevalent in England at that time, he was refused access to the programs for deaf education in both London and Edinburgh. Gallaudet then traveled to Paris, where the Abbé Sicard instructed him in the language of signs and the manual alphabet.

Stokoe (1971) observed that although education of the deaf in America commenced with signs upon Gallaudet's return, for the past century "'signing' has been strictly prohibited in a few schools, discouraged or neglected in the rest [p. 1]." Oralism, an educational technique restricted to speech, speechreading, writing, reading and hearing amplification, has dominated the administration and education of deaf students (Alterman, 1970). However, in the past several years leading scholars in the area of deafness (Mindel & Vernon, 1971; Moores, 1970b) have called for a reformulation of deaf education, with the introduction of sign language along with oral training in a program of total communication for the deaf.

The use of manual communication (signs and fingerspelling) has a long history; in fact, the Egyptians, Hebrews, Greeks, and Romans appeared to have used a finger notation or symbolization (Best, 1943). Best noted that illustrations of the manual alphabet extend back into the early Christian era, and that the Venerable Bede in the seventh century had referred to three different forms of the manual alphabet. Abernathy placed the origin of the first regular instruction of the deaf and use of signs with Pedro Ponce de Leon in sixteenth-century Spain. Abernathy heralded the publication by Juan Pablo Bonet of the letters of the one-hand alphabet, in 1620, as another milestone in the education of the deaf.

Both Abernathy (1959) and Seigel (1969) stressed the important role of Charles-Michel de l'Épée in the education of the deaf. In Paris, Abbé de l'Épée founded the first institution in France for the deaf, irrespective of social condition, and formulated the first systematic method of education for the deaf with the publication in 1776 of Institution des sourds et muets par la voie des signes méthodiques. Seigel wrote that de l'Épée understood language as essentially an organized and structured system of symbols, a viewpoint that does not appear to differ too much from Ervin-Tripp's (1966) requirements of a language: "Any symbolic system which is learned, which consists of conventional basic units and rules for their arrangement, and which includes a conventional set of arbitrary signs for meanings and referents [p. 56]." Roch-Ambroise Cucurron Sicard became the head of the school in Paris with the death of de l'Épée, and it was the techniques of de l'Épée that were introduced in the United States after Gallaudet's return.

Seigel said that the British failed to develop a language of signs, because early education of the deaf in England was conducted primarily by charitable organizations and manned by fierce evangelical reformers. Seigel (1969) claimed that English oralism, based on the beliefs that "speech is a gift of God and that its imperfection is a 'most melancholy proof' of man's fall, that the 'breath of life resides in the voice,' and that the voice is the 'interpreter of our hearts and signifies its affections and desires' [p. 97]" stemmed from the 1700 work of Johann Conrad Amman, a Dutch oralist pioneer.

Seigel noted that the books by John Herries (The Elements of Speech, London, 1773), Joseph Watson (Instruction of the Deaf and Dumb, London,

1809), and Francis Green (Vox Oculis Subjecta, London, 1783) were based on the premise that human speech was the distinguishing characteristic between human beings and animals. This same view inspired Samuel Heinicke to develop the oral language program for the deaf in Germany (Schmaehl, 1970).

2. Cognitive and Intellectual Development

Pintner, Eisenson, and Stanton (1941) reviewed a series of studies of mental development in the deaf and found that on the average the deaf child was about 10 points below the hearing child in IQ on nonlanguage and performance tests. Nisbet (1961), citing the evidence marshalled by Pintner, et al., argued cogently that the restriction of the normal language growth in deaf children depresses their performance on intelligence tests.

In recent reviews of the literature on the performance of deaf and hard-of-hearing children Mindel and Vernon (1971) and Vernon (1967, 1968b) disagree with the earlier claims of a cognitive deficit. In his 1967 review of 31 studies performed between 1930 and 1966, in which he compared hearing-impaired subjects with either normal controls or test norms, Vernon claimed that the deaf had superior median or mean scores in 13 of the studies, inferior scores in 11, and no significant differences in 7. In their 1971 review, Mindel and Vernon stated that it has been "conclusively demonstrated by over fifty independent studies that deaf and hard-of-hearing people have essentially the same distribution of intelligence as the general population [p. 87]."

Among the problems to be considered in evaluating the intellectual ability of the deaf is the higher incidence of neurological impairment

or brain injury among deaf subjects. Pintner et al. originally formulated the hypothesis that the slight arrest they observed in mental development of the deaf might be due to the same diseases that caused the deafness. Vernon (1968a) also suggested that the disease conditions that cause deafness might account for the slightly higher prevalence of low IQ's among deaf and hard-of-hearing students. Other factors that might confound the test results could be the generally lower socioeconomic class and vocational status of the deaf (Mindel & Vernon, 1971; Pintner et al., 1941), a greater incidence of emotional problems (Schlesinger & Meadow, 1971), and the difficulties of presenting test instructions to deaf subjects (Vernon, 1967). Vernon especially criticized the early research involving the Goodenough Draw-A-Man Test on the grounds of language problems inherent in comprehending the directions.

The question underlying much of the early research of deaf children's knowledge and their use of language is whether language facilitates conceptualization, or, inversely, whether the absence of language indicates an inability to conceptualize. This problem was examined on the assumption that the inability to hear and the concomitant inability to speak precludes the possibility of learning language naturally. Deaf children appeared to be the ideal population on which to test one aspect of the Sapir-Whorf hypothesis--does the structure of language influence the way one thinks, and does the absence, or a relative dearth of language correlate directly with an inability to think, to understand, and to solve problems?

Jean Piaget has long emphasized the importance of an operative theory of intelligence and challenged the importance of language learning in

intellectual development. Inhelder and Piaget (1964) and Piaget (1970) stressed the priority of logical operations to language and viewed language rather as a symptom of underlying cognitive structures. Aside from his own research, Piaget (1969) referred to the supportive findings of Sinclair-de Zwart (1967) who studied the relations between operational and linguistic levels in children between the ages of five and eight years, and the studies of Furth (1966b) and Oléron and Gumusyan (1964) with deaf children.

Furth (1971) recently completed a review of 39 studies undertaken during the past decade that involved deaf and hearing subjects. Although he noted that the deaf subjects were delayed in their development of logical structures, Furth concluded that the "thinking processes of deaf children and adolescents were found to be similar to hearing subjects [p. 58]."

After reviewing Furth (1964), Blank (1965) criticized Furth for his sweeping conclusion that "Language does not influence intellectual development in any direct, general or decisive way [p. 160]." Furth (1971) disagreed that the evidence he had presented had been inadequate to show that thinking can develop without the benefit of language. He divided the 39 reviewed studies into five subareas: Rule Learning, Logical Symbols, Piaget-type (transitivity, conservation, seriation), Memory, and Perception. Although the deaf subjects evinced a developmental time lag compared with the hearing subjects, Furth claimed that these studies confirmed his position that the language deficit shared by the deaf did not permanently hinder their cognitive performance up to and including the stage of concrete operational thought.

Carroll (1964) agreed with the conclusions of Furth and Oléron that the congenitally deaf child without speech can acquire concepts and perform at a level of cognitive functioning above that of primates. Carroll summarized his view: "These findings suggest strongly that there can be a kind of 'thought' without language [p. 74]." Similarly, Rosenstein, in a 1961 review of the literature, agreed with Oléron's statement that the sphere of abstract thought was by no means closed to the deaf, although Rosenstein did not exclude the possibility that "the access to it is more difficult for the deaf than the hearing [p. 283]."

One recurring problem in investigations by cognitive psychologists of the relationship between language and thought is a confusion concerning the difference between speech and language. Speech is only one aspect of the total mode of communication. Even if a deaf child could perform all the appropriate phonological rules for the mapping of sounds to surface structures (speech), he would need also to master syntax, morphology, and vocabulary in order to master language. However, the failure of the deaf child to produce speech does not definitely indicate any underlying nonexistence of deep structure, knowledge about syntax, vocabulary, etc. Therefore Furth's many statements about the congenitally deaf child being without language might best be explained by saying that the congenitally deaf child is without intelligible oral speech and has a poorly developed vocabulary and knowledge of English syntax and morphology.

Furth appears to have modified his views about the interaction of thought and language in light of recently completed research (Furth & Youniss, 1971). Furth's earlier studies were in the domain of concrete operations. In an attempt to see if formal operations could emerge in

persons with poor linguistic knowledge, Furth and Youniss selected deaf adolescents and tested them on tasks of logical use of symbols, probability, and combinatorial manipulation. Control groups consisted of students from a rural high school and students from a middle-class suburban high school.

Furth concluded that "Language is more closely related to formal than to concrete operations in that it provides a figurative medium for symbolic statements. Symbolic propositions are the proper object for thinking that has reached the formal operatory stage...the evidence from our work with linguistically deficient persons indicates that it may have an indirect facilitating effect for concrete operations, but can have a direct facilitating effect on certain formal operations precisely because of the class relation between formal operations and symbolic functioning [p. 63-64]."

If a person does not develop facility at formal operational thought his opportunities for achievement in contemporary society will be severely constricted. Inhelder and Piaget (1958) considered the central property of formal operational thought to be the individual's understanding of the real versus the possible. Flavell (1963) wrote that formal operations are necessary "to envisage all possible relations which could hold true in the data and then attempts, through a combination of experience and logical analysis, to find out which of these possible patterns in fact do hold true [p. 204]." Formal operational thought consists of a cognitive strategy that is not unlike the scientific method.

A more recent study (Youniss, Furth, & Ross, 1971) examined logical-symbol use in deaf and hearing adolescents. Once again, deaf subjects

initially performed at lower levels than hearing controls, but many of the deaf subjects, when given additional training, achieved the highest levels. The experimenters interpreted these findings as supporting their view that "logical development can occur when there is no direct internalization of a societal language and that deaf adolescents are capable of propositional thought despite their language deficiency [p. 511]."

Unfortunately, none of the above studies attempted to measure how much English the deaf students knew, or what degree of proficiency in American Sign Language they had. Also, the factor of retarded emotional maturity often present in deaf students might have affected their performance. Further research comparing the formal operational thinking of the deaf (and taking into account both proficiency in English and sign language) with that of hearing and deaf people from radically different language backgrounds should be undertaken.

3. Psycholinguistic Approaches

The recent upsurge in studies by psychologists, linguists, and psycholinguists into the nature of language has provided a framework from which to investigate the language ability of deaf subjects. Inspired by Fodor and Bever's (1965) finding that hearing subjects tend to perceive auditorily presented clicks at constituent (phrasal) boundaries, Odom and Blanton (1967) attempted to determine whether the English that prelinguistically deaf persons process cognitively is the same language that hearing subjects use with regard to phrase structure. Two groups of deaf subjects were compared with one group of hearing fifth graders and one group of hearing twelfth graders (controls for reading level and

age, respectively) on the learning of segments of written English. One-third of the English segments were "phrasally" defined ("paid the tall lady"), one-third were not "phrasally" defined but were in acceptable English word order ("lady paid the tall"), and the final one-third were scrambled words ("lady tall the paid"). The experimental task required the subjects to recall the entire segment correctly after 12 study-test trials. The results:

Analyses of the mean number of words recalled correctly and the probability of recalling the whole phrase correctly, given that one word of it was recalled, indicated that both ages of hearing subjects showed facilitation on the phrasally defined segments, interference on the scrambled segments. The deaf groups showed no differential recall as a function of phrasal structure [Odom & Blanton, 1967, p. 600].

Since the deaf subjects showed no differential performance on the differing linguistic structures, Odom and Blanton concluded tentatively that the deaf "do not have the same mechanism or processes operating with regard to English structure as do hearing subjects [p. 605]."

Odom, Blanton, and Nunnally (1967) performed a series of "cloze" technique studies of the language ability of both deaf and hearing subjects. In these studies the subjects were required to fill in one or more words deleted from a sentence. In two different samples of deaf students, the deaf students performed at a much lower level than a control group of hearing subjects. The authors found that "syntactic (function) words were more difficult to recognize and restore than semantic (content) words [p.826]." They also found that the deaf, unlike the hearing students, increased their ability to predict the correct form class of function words as the span between deleted words increased. The experimenters suggested that the deaf used different types of rules from the

hearing subjects in constructing sentences, particularly with regard to function words.

Odom and Blanton (1970) noted in the cloze technique studies that while reading-achievement level scores were positively correlated with the scores on the cloze procedure for hearing subjects, the scores were uncorrelated for deaf subjects. In an attempt to determine the relationship between deafness and reading achievement, Odom and Blanton compared the performance of deaf and hearing subjects on three different types of reading material. Type I was a Standard English version of a paragraph comprehension test. Type II was a series of paragraphs containing the same information as the Standard English form, but designed to approximate the syntax of sign (manual communication). Type III was the same series of English paragraphs, only scrambled. The hearing subjects scored highest on Type I (Standard English), next highest on Type II (sign paragraphs), and lowest on Type III (scrambled English). The deaf subjects performed best on the paragraphs designed to conform to the word order of American Sign Language, next best on the Standard English, and worst on scrambled English.

A number of studies of the word-association patterns of the deaf which also fit into the overall pattern of retarded verbal ability of the deaf child have been carried out. Nunnally and Blanton (1966) found that the deaf gave relatively more associations that could have been learned from visual experience and from reading simple materials. Nunnally and Blanton also found that their deaf subjects were frequently unable to give any association, which suggested to them that "as a group, words are less meaningful to the deaf than to normals [p. 87]." Koplin, Odom,

Blanton and Nunnally (1967) found that word associations of the deaf are comparable to those of younger hearing subjects. Jacobson (1968) found that unlike the hearing children in Brown and Berko's (1960) study, deaf children do not show regular and substantial increases with age in paradigmatic versus syntagmatic responses; in four of the six parts of speech examined, there was a decrease in the number of paradigmatic responses from younger to older.

Odom, Blanton and McIntyre (1970), in a word-learning task, found that deaf subjects recalled most words as well as the hearing controls; further, they recalled those words that had sign-language equivalents much better than the hearing controls, who did not know sign language. The authors concluded from this finding that there are definite advantages to sign language versus fingerspelling as a mode of instruction for the deaf.

Goetzinger and Huber (1964) found that deaf subjects performed at an equivalent level to hearing subjects on tests of immediate recall, but performed significantly poorer than the hearing subjects on the test of delayed recall. Blanton and Nunnally (1967) investigated the effect of rated pronunciability (PR), in retention of trigrams by deaf and hearing subjects. Blanton and Nunnally found that deaf students performed equally well on high PR and low PR items and were superior to the hearing students in overall performance; hearing subjects performed significantly better on high PR items than on low PR items. In a supplementary report, Blanton and Odom (1968) concluded that "hearing S's are subject to interference effects in attempting to pronounce difficult items which reduces rate of learning [p. 844]."

A possible roadblock in teaching deaf children to read might be their inability to discriminate words on the basis of sound. Gibson, Pick, Osser and Hammond (1962) proposed that units for reading are formed by a relatively invariant mapping of speech sounds. Several other interpretations were later evolved by other psycholinguists invoking auditory encoding and matching to an articulatory representation or plan. Gibson, Shurecliff and Yonas (1968) attempted to test these hypotheses by using 31 congenitally deaf subjects from Gallaudet College who had maximal hearing loss:

...deaf and hearing subjects were compared for the ability to read, under tachistoscopic presentation, letter strings (pseudo words) which did or did not, follow rules of orthography which rendered them pronounceable or relatively unpronounceable. Deaf as well as hearing readers were more successful in reading the pronounceable ones. This finding must mean that orthographic rules were used by these subjects even though the invariant sound mapping was not available to them [p. 32].

An experiment performed by Doehring and Rosenstein (1960) provides support for the Gibson claim that the deaf can perceive differences between pronounceable (CVC) and unpronounceable (CCC) words. In the Doehring and Rosenstein experiment lists of trigrams were presented tachistoscopically to both deaf and hearing children. One list was all CVC; the other list all CCC. Both the deaf and the hearing children made significantly fewer errors on the CVC trigrams. The differences obtained by Doehring and Rosenstein for the deaf subjects appear to contradict the conclusions presented by Blanton and Nunnally (1967) and Blanton and Odom (1968). However, it should be noted that Rosenstein and Doehring used both CVC's and CCC's, while Blanton's studies employed

CVC's rated on pronunciability. A distinction should probably be made between pronunciability per se and relative frequency of a cluster in the written language. Use of CCC's may be a poor way to test the hypothesis of pronunciability.

The work of Odom, Blanton, and Nunnally and a series of studies by Allen (1969, 1970, 1971) provide evidence that the deaf student may employ strategies different from hearing students to retain and recall information. Conrad (1970) suggested a dichotomous classification of deaf subjects based on articulatory and visual coding of short-term memory. Conrad found that this classification correlated significantly with teachers' ratings of speech quality. Locke and Locke (1971) examined the role of phonetic, visual, and dactylic (fingerspelling) coding of letters in a recall task with deaf subjects with both intelligible (ID) and unintelligible (UD) oral language and hearing controls (HC). Locke and Locke found that the hearing controls made the most errors on the basis of phonetic similarity, followed by the ID and the UD groups. Both visual similarity and dactylic coding errors were more prevalent in the UD group, followed by the ID and HC groups. The authors suggested that the teaching of different communication codes to the deaf might affect the nature of recall from short-term memory.

4. Educational Achievement and Reading Ability

Pintner et al, examined the age of onset of deafness and educational achievement and found that children who became deaf postlingually were able to achieve relatively more on educational tests than the prelingually deaf. The authors summarize:

This effect of the age of onset of deafness on educational achievement is not reflected in intelligence as measured by our nonlanguage tests. There we found those born deaf or those deaf at an early age just as intelligent as those who become deaf later on. It would seem, therefore, to be the specific use of language for four to six years or more that leaves a permanent effect on later educational achievement [p. 135].

Studies undertaken during the past fifteen years have probed the educational and reading performance of the deaf child. Goetzinger and Rousey (1959) and Miller (1958) found that the educational attainment of the deaf child fell far below that of hearing students with comparable backgrounds, and Moores (1970b) summarized this position in terms of a cumulative deficit: the deaf child commences his education at a disadvantage, and his academic development increases at a rate significantly slower than that of hearing children, so that the relative difference between the two groups becomes greater over time.

In the comprehensive study undertaken by Wrightstone, Aronow and Moskowitz (1963) 5,224 deaf students between the ages of 10-1/2 and 16-1/2 years of age were carefully tested to establish reading grade norms for deaf children. The scores of the deaf children were compared with the reading grade norms of hearing children: The mean grade equivalent scores for the deaf students increased from grade 2.8 to grade 3.5 in the six years from age 10-1/2 to 16-1/2.

Furth (1966a) pointed out that the youngest age group of deaf children (10-1/2 to 11-1/2, N = 654) had a mean raw score of 12.6, barely above the chance level of 11. Furth noted that many of the higher scores by deaf children might be attributed to random guessing; also, many of the questions did not really require comprehension of the material, but

more often a simple matching of the material to words in the reading sample. Only about a fifth of those deaf students who continued in school ever attained a reading grade equivalent score of 4.9 or better. Furth noted that since it was generally recognized that reading tests below Grade 4 largely sample only fragmentary aspects of language, only a small percentage of deaf students had developed a functionally useful ability to read.

The more recent studies by Boatner (1965) and McClure (1966) examined 93 percent of the deaf students in the United States aged 16 years or older, and largely support the earlier findings of severe retardation in reading performance. The investigators found that only 5 percent of the students were reading at grade level 10 or better, 60 percent at grade level 5.3 or below, and about 30 percent were functionally illiterate. The investigators noted that most of the higher scores were obtained by students who were hard-of-hearing or adventitiously deafened.

Although comparison of educational attainment between populations from qualitatively different institutions is difficult, Schein and Bushnaq (1962) attempted to measure educational attainment by studying the relative percentages of deaf and hearing students attending college. Schein and Bushnaq found that 1.7 percent of the deaf school-age population attended college compared with 9.7 percent of the hearing school-age population. Furthermore, the percentage of deaf youth entering college has been declining while the percentage of hearing youth has been increasing.

5. Analyses of Deaf Children's Written English

Myklebust (1964) reviewed the growth of verbal facility in the deaf child:

It is significant psychologically and educationally that there was little growth in verbal facility as they (deaf children) increased in age. In general, these data indicate that the group achieved a level of verbal facility equal to about two-thirds of the normal and that this ratio of achievement showed little change as they progressed through school. Perhaps this indicates that after they attain a degree of verbal usage, they reach a plateau beyond which further language growth is negligible [p. 72].

Schulze (1965) studied the vocabulary development of adolescent deaf students over a three-year period. She found that their writings became more lengthy and showed a greater number of words per communication, and that their vocabulary developed well in its proportion of adjectives, adverbs, prepositions, and verbs. Even so, their vocabulary was meager and showed approximately a four-year lag in development in comparison with hearing students matched by age. Also, only 56 percent of their vocabulary was common to the three studies of hearing students to which she referred. The research of Templin (1966, 1967) also revealed that deaf children are significantly inferior in their vocabulary development and in the way they use their vocabulary.

Stuckless and Marks (1966) reported a small positive correlation with age over a 9-year-age sample (10 to 18 years) on each of six indices of language usage. Essays written by the deaf students were scored on length of composition, sentence length, word ratios (adjectives, adverbs, and function words to all words), grammatical correctness and spelling accuracy.

Marshall and Quigley (1970) have been performing more complex analyses of the written language of hearing-impaired students over a nine-year period. They have found that although the deaf subjects improved

in their written language over time (measured in terms of sentence length in words, syntactic complexity by number of clauses per sentence and ratio of subordinate clauses to main clauses), the deaf subjects were far behind hearing students of their own age in the grammatical complexity, and hence the maturity, of their writing samples.

6. Sign Language

Aside from the studies by Stokoe (Stokoe, 1960, 1971; Stokoe, Casterline & Croneberg, 1965) and McCall (1965), apparently little formal linguistic analysis of American Sign Language had been performed until the past year. The exciting work of the Gardners (1969), in which they taught sign language to a chimpanzee, coupled with the increase in interest in both linguistics and problems of disadvantaged children during the past decade, has helped stimulate new research in sign-language structure. Earlier generalizations on the grammaticality of sign language appear to be based on a subjective impression rather than a detailed analysis (e.g., Fusfeld, 1958, "Often signs follow in unconventional order, unheeding of the pattern a sentence takes in customary usage. Adjectives, adverbs, nouns and pronouns hold to no set sequence...[p. 267]").

The results of current investigations into the structure of sign language may lead to a major reconceptualization of the nature of a language. Most linguists (i.e., Bloomfield, 1933; Hockett, 1958; Lyons, 1968; Sapir, 1966; Weinreich, 1966) have stressed the sound, or phonological, system as a defining characteristic of languages and as the medium for the expression of communicable thought. Bloomfield dismissed the language of the deaf simply as "developments of ordinary gestures"

and added that "any and all complicated or not immediately intelligible gestures are based on the conventions of ordinary speech [p. 39]." Sapir, on the other hand, acknowledged that "As a matter of theory, it is conceivable that something like a linguistic structure could have been developed out of gesture or other forms of bodily behavior [p. 1]," but he never elaborated upon this idea. Weinreich presented a definition of language that could conceivably be filled by sign language: "...a language is a repertory of signs, and that discourse involves the use of these signs, seldom in isolation. The rules of permitted sign combination (grammar) are formulated in terms of classes of signs (grammatical classes). Languages contain signs of 2 kinds: every sign is, in general, a designator or a formator [p. 145]." Nonetheless, he excluded, as non-language, any system that does not use vocal sign vehicles. Although linguists have, in general, chosen to ignore sign languages in their discussions of languages, Stokoe (1960) observed that the communicative patterns out of which sign languages developed might have been the primary means for early human communication, with vocal interaction playing only a minor part.

The meanings associated with most of the signs in American Sign Language are based simply on the usage of the sign within the deaf population. However, for a large number of signs there may be an observable relationship between the sign and its referent. (There are, similarly, a small number of onomatopoeic words in English.) Stokoe et al. distinguished the different observable relationships that could exist between a sign and its referent:

1. Pantonymic signs are signs in which an action represents itself.
2. Imitative signs are signs in which one important feature of the whole action or object is singled out to represent the whole.
3. Metonymic signs are signs in which a relatively unimportant or unexpected feature of the object or action is used to represent the whole.
4. Indicative signs are signs where the action is the pointing towards the referent.
5. Initial-dez signs are signs in which the letter configuration from the manual alphabet for the first letter of the signed word is used.
6. Name signs are specific and often personal signs used to refer to an individual person.

Battison (1971) also discussed the relationship between signs and their referents, but chose to code the transfer of meaning from sign to referent with two binary features: [+ metaphoric] and [+ metonymic]. Independent of the two approaches, the observable range in relationships between sign and referent provides a unique opportunity for psycholinguistic investigations of meaning.

McCall and Stokoe agree that American Sign Language grammar consists of both a rule-based syntactic system and a lexicon or vocabulary of signs. McCall found similar constructions repeated throughout her corpus and argued that this grammatical regularity fulfills the requirement of structural consistency inherent in true languages.

McCall observed that the constructions generated in American Sign Language appear to be significantly different from English and are unique in terms of linguistic structure. Stokoe noted that the signing used in McCall's corpus was obtained at picnics and other social functions, and hence was probably more casual and intimate than normal. He felt that

this might cause her grammatical analysis to be inappropriate as a general description of American Sign Language. Stokoe himself (1969) utilized Ferguson's (1959) definition of diglossia ("two or more varieties of the same language are used by the same speakers under different conditions [p. 325]") to describe the observed variation in American Sign Language. He found a 'high' variety (signed English, which includes fingerspelling of English constructions) and a 'low' variety (colloquial sign language).

Fant (1972) outlined some of the differences between American Sign Language, as generally used by the deaf, and English. Among the differences he noted are the absence in American Sign Language of word inflections (seat = 'sit', 'sits', 'sitting', 'sat', etc.), of the passive voice, and of the different grammatical moods. The deaf also omit articles, but often sign 'that' in place of 'the' before an object or event. Prepositions which show location or movement are signed, whereas prepositions such as 'by', 'at', and 'of' that appear to serve a more structural role in sentence formation are not signed. There is no sign for the copula 'be', and the sign for 'true' is often used for 'am', 'is', 'be', etc. Fant also examined deaf signers' usage of pronouns, negation, questions, and tense and observed numerous differences in formation (e.g., time indicators are generally employed in place of verb tense). Fant characterized the syntax of American Sign Language as usually resembling short, simple declarative English sentences arranged sequentially in chronological order. Moores (1970b) commented on the dearth of interstitials or function words in American Sign Language and observed that this absence of function words could present obstacles to the deaf child's development of English language skills.

I. M. Schlesinger (1970) in a study of Israeli Sign Language (ISL) raised a number of problems for the study of language universals. He designed a series of problems to first determine whether ISL has a syntax, and if it does, whether this syntax relies upon a set word order. The experimenters made up a set of pictures which depicted the grammatical relations Agent, Object, and Indirect Object. Subjects were deaf adults of various ages from Haifa and Jerusalem, some of whom had been taught Hebrew in school. In the experimental task, two subjects were seated opposite each other at a small table, with a low screen between them so that they could not see each other's pictures. The task was for one deaf subject to describe a picture to the other in ISL; the other subject chose the picture in his pile which he thought was being described. Results showed that ISL does manifest certain aspects of syntax, but apparently has no word-order mechanism to show the relations 'agent of', 'object of', and 'indirect object of'. It was also found that the verb, although often omitted, never occurred initially, and that the adjective always followed the noun. Except for Agent, Object, and Indirect Object, all possible sequences were used at least once. There was no consistency in the use of word order, even for the same subject, and consequently, there was a great deal of misunderstanding between the partners in the task.

I. M. Schlesinger raised the question of language universals at the end of his paper. Is it possible, then, that ISL does not contain the relations 'subject of', 'object of', and 'indirect object of', and therefore, is it possible that these syntactical relations are not universal? Or, does ISL manifest some universals in its base, but not others? I. M. Schlesinger noted that the younger subjects who had learned some Hebrew

tended to use the word order of Hebrew, but the older subjects, probably immigrants from other countries, did not.

Stokoe (1960) found three different aspects that distinguish each sign in American Sign Language from all other signs in the language: The place on or near the body where the sign is performed; the configuration of the hand or hands making the sign; and the movement or the change in configuration of the hand or hands. Stokoe calls the location aspect the tabula (tab), the active hand the désignator (dez), and the action performed the signation (sig). He listed 55 different tab, dez, and sig symbols and proposed the names 'chereme', and 'allocher' to correspond to the comparable phonological terms of phoneme and allophone. Stokoe et al. later added the concept name 'morphochereme' to correspond to the linguistic concept morphophone, the elemental language unit out of which the morpheme, or minimum meaning bearing unit is generated. The simultaneous production of phonological and morphological levels in vocal language is paralleled in American Sign Language (ASL) by the simultaneous production of the cheremic level (consisting of configuration, position, and movement) and the morphocheric, or symbolic, level. Stokoe also pointed out one aspect of ASL which has no parallel in spoken languages. Certain signs may be produced simultaneously, whereas words and/or morphemes are always sequential. Fischer (1971) examined the processes of reduplication in American Sign Language and found differences in the greater number of reduplications allowable in American Sign Language compared with the usual single repetition in spoken language. She also suggested the presence of a number of meaning-bearing features (e.g., fast, horizontal, boring) that were involved in the reduplication.

Bellugi and Siple (1971) and Klima and Bellugi (1972) performed a series of experiments confirming the psychological reality of the classification parameters developed by Stokoe. Deaf subjects were presented with a list of 150 signs, one per second. The subjects were then asked to recall as many of the signs as they could in one of two ways: either by signing or by writing the English equivalents. Where hearing subjects, who were given a word list to memorize, made formation errors--confusing the stimulus word with a word which differed with respect to one or two phonemes--many of the deaf subjects made errors by incorrectly substituting on one of Stokoe's classification parameters.

7. The Acquisition of Language

Lenneberg, Rebelsky and Nichols (1965) examined the vocalizations (crying and cooing) of deaf and hearing infants during the first three months of life and found no significant differences between the two groups. They concluded that crying and the emergence of cooing were dependent on maturational readiness and not contingent upon specific acoustic stimuli. Lenneberg et al. at the same time compared the spoken language of the deaf mothers with that of hearing mothers and found that deaf mothers' speech was at an abnormal pitch, and possessed dramatically different intonation patterns and a general inability to control intensity of sounds.

The deaf child usually continues to develop a normal pattern of vocalizations until about six to nine months. Fry (1966) noted that when auditory feedback began to appear important to the normal child, babbling began to fade in the deaf child.

Lenneberg (1966, 1967) hypothesized the presence of a critical period for a child's acquisition of language, bounded on one end by the child's cerebral immaturity and by a "termination of a state of organizational plasticity linked with lateralization of function at the other end of the critical period [1967, p. 176]." Lenneberg noted that 60 percent of the mature values (lateralization) were present at the onset of speech at about two years of age and underlined the importance of the age period from 21 to 36 months for the child's acquisition of language.

The work of Vernon and Koh (1971) provided some evidence that early learning of manual communication facilitates later academic achievement and written language ability. However, contrastive studies of the differences in sign-language usage relative to the age of acquisition have not been reported. It would be interesting to observe if evidence for a critical period for language acquisition exists in a primarily visual and motor language.

Hilde Schlesinger (Schlesinger & Meadow, 1971) recently completed a longitudinal study of the acquisition of sign language in four congenitally deaf children. She concluded that the stages in the acquisition of sign language closely parallel the stages in the language acquisition of hearing children. Recent studies of sign language as used by deaf children (Bellugi, 1970; Tervoort & Verbeck, 1967) also indicated that the development of sign language parallels the development of correct grammatical usage in hearing children.

The four children in the H. Schlesinger study suffered from a severe hearing loss (at least an 80 decibel loss in the better ear), but differed as to age of entrance into the study, age of introduction to manual

communication, etiology of deafness, and parental hearing status. The subjects and their ages (year; month) at the commencement of the study were: Ann (0; 8), Karen (2; 7), Ruth (2; 8), and Marie (3; 4).

H. Schlesinger observed that the first signs produced by Ann (an only child of a young deaf couple), were holophrastic, both in the sense of having a broad and ill-defined meaning and in the role of expressing complex ideas. Like Leopold's daughter, Ann overgeneralized the referential aspect of her early signs (e.g., at 16 months, Ann used the sign 'dog' to refer to real dogs, pictures of dogs, the Doggie Diner, other animals, and people). H. Schlesinger also reported examples of complex meanings: 'Smell' (at 15 months) had the English equivalents of "I want to go to the bathroom," "I am soiled please change me," and "I want the pretty smelling flower." H. Schlesinger outlined Ann's motor and linguistic development, and noted that in comparison with hearing children, her language growth was accelerated. At 18 months Ann had a vocabulary of 117 signs, while Lenneberg (1967) found that a vocabulary of more than three, but less than fifty words is normal for hearing children.

Karen received simultaneous sign and speech input from the time of her adoption at 17 months. H. Schlesinger identified a number of pivot-like constructions in Karen's signing and observed that these constructions were consistent with the findings reported in Brown (in press). H. Schlesinger noted that like Bowerman's (1969) findings, signed pivot words (e.g., 'more') can occur alone in combination with other signed pivot words (e.g., 'please more'), and may occur in both the initial and final positions (e.g., 'come + eat' and 'B-U-S + come'). H. Schlesinger also found that Karen's signed constructions provided support for Bloom's

(1970) analysis of structural meaning at the two-word stage. Examples (from H. Schlesinger):

1. Locative: "Daddy work" - daddy is at work;
2. Genitive: "Barry train" - the train belongs to Karen's brother, Barry;
3. Attributive: "Bed shoes" - refers to a pair of slippers;
4. Agent-Objective: "Daddy shoe" - Karen tells her father to take off his shoe and get in sandbox with her.

Ruth, a rubella infant who was taught sign language by hearing parents, provided an index of the rapid vocabulary growth that occurs at about age three. Ruth at her third birthday had a total vocabulary of 348 signs; four months later she had added 256 new signs to her repertoire. Interesting to note was the relative dearth of function words in her total vocabulary--nouns, adjectives, and verbs accounted for 95 percent of her total vocabulary, whereas pronouns, articles, prepositions, conjunctions, adverbs, and interjections together accounted for only 5 percent.

Marie, an adopted rubella child, was instructed in SEE (Seeing Essential English) from the age of three years. H. Schlesinger noted that Marie appeared to acquire negation in the stage format comparable to that described by Bellugi. An examination of Marie's lipreading ability at age 3 years and 10-1/2 months revealed a score significantly higher than normal for deaf children at both the ages of four and five years, leading H. Schlesinger to conclude that "use of sign language and fingerspelling did not interfere with her lipreading facility and may well have helped it [p. 204]." H. Schlesinger also performed a communicative mode count (speech only, sign only, both), on Marie and Ruth and found that as they acquired sign language, the amount of spoken English also increased.

8. Education of the Deaf

Schools and classes for the deaf serve both deaf and hard-of-hearing children. Thus the range of hearing loss in a classroom for the deaf may begin somewhere around 40 db in the 250 to 4,000 Hz range in the better ear (mild hearing loss) and continue up to losses of more than 90 db (profound hearing loss). Schools, depending upon whether they are private or state institutions, will probably differ in their definition of deafness and their entrance requirements in terms of hearing loss.

Various methods of educating the deaf are employed in the United States. Schools may be either public or private, residential or day. Most state schools are residential, although this trend is changing. In addition, regular public schools may have special programs for hearing-handicapped children within their normal curriculum. The teaching techniques used may be purely oral, or a combination of oral plus any of a number of manual methods. The Oralist-Manualist Controversy is thus actually a misnomer, since all schools that employ some sort of manual method also teach oral skills (speech and speechreading)--although they may emphasize residual hearing to a lesser degree than pure oral schools. Moreover, even though the deaf child may be enrolled in an 'oral' school, he will often pick up sign language from his contemporaries.

Oral schools in the United States usually discourage or prohibit the use of American Sign Language and/or fingerspelling. In the East, and in most state residential schools throughout the country, the oral method is the primary mode of instruction for the deaf. (In Massachusetts, according to Mindel and Vernon, 1971, use of manual communication in the classrooms of the state schools for the deaf is prohibited by law.)

Most oral schools teach mainly vocabulary in the first grade, with emphasis placed on words that are easily 'read' from the lips (Neesam, personal communication, 1972). From second grade on, the deaf child is taught to construct simple sentences--although 'construct' may not be the correct term, since this may be largely rote memorization. A number of teaching devices have been developed to assist the deaf child in acquiring English grammar, notably the Fitzgerald Key and Wing's Symbols. The Key can perhaps best be described as a Pikean Tagmemic grammar, which uses a 'slot and filler' method devised for analyzing foreign languages, to attempt to teach the deaf child to distinguish between the various parts of speech and to use them properly in sentences. There may be little spontaneous use of the language skills taught, however. In their observations of an oral school for the deaf, Craig and Collins (1970) found that the students rarely initiated communication in their classes.

Standardized reading materials, which take into account the special problems which deaf children encounter in acquiring English have, for the most part, not been devised. Consequently, standard elementary-school texts for hearing children are used in most schools for the deaf (Hargis, 1970).

Computer-assisted instruction programs in language arts (grammar), as well as mathematics and some other academic subjects, are in use in a number of schools for the deaf (Suppes, 1971). The application of such programs to education of the deaf is quite new and is only beginning to be evaluated.

In Rochester, New York and a few other places, the oral technique is combined with fingerspelling in what is called the Rochester Method

(Scouten, 1967). Utterances are simultaneously spoken and spelled using the manual alphabet.

Cornett (1967), at Gallaudet College, recently developed a variation of the oral method, called Cued Speech. This is speechreading accompanied by a few specially devised hand movements (not signs) performed by the speaker near his face. These gestures act as 'distinctive features', to signal differences between phonemes, which cannot be read from the lips alone (e.g., the voicing distinction of /b/ versus /p/). There are as yet no reports of its use in teaching English to young deaf children.

The Simultaneous Method, also referred to as "Total Communication" (Santa Ana Unified School District, 1971), is used in an increasing number of schools for the deaf and in a few preschool programs. This method combines the oral skills--speech, speechreading, reading and writing--with the American Sign Language and fingerspelling (particularly for those words which have no American Sign Language equivalents). A distinction is made between American Sign Language as it is used in the classroom ("Signed English" or "Siglish," Fant, 1972), which involves manual signs conforming to the morphology and syntax of English, and American Sign Language as it is used informally among family and friends ("Ameslan," Fant, 1972), with its own distinct syntactic patterns. There is apparently no school in the United States which officially employs Ameslan as a medium of communication and instruction.

One of the variants of Signed English presently being taught and used as a medium of instruction is SEE, which was developed by D. Anthony and G. Addletweed (Washburn, 1972). This system of signing attempts to duplicate the entire morphology of English, providing signs for English

articles, inflections, tense markers, pronouns, and other items which would normally have to be fingerspelled in ordinary signed English. The goal of this method is to bridge the gap between the morphology of signs and English, and thus to facilitate the acquisition of written English, reading ability, and spoken English by the deaf child. SEE is presently being used in a few classes and preschool programs for the deaf in California.

There are presently only two institutions of higher learning specifically for the deaf in the United States. These are Gallaudet College in Washington, D.C., which is primarily a liberal arts university and teacher's college, and the recently founded National Technical Institute for the Deaf in Rochester, New York, a science and technical college. In addition, certain colleges (for example, San Fernando Valley State College, Northridge, California) provide interpreters for the deaf in regular classes, who will sign, mouth, fingerspell and write out lectures for deaf students.

9. Oral vs. Sign

Alterman (1970) reviewed the development of the two primary means of communication among the deaf--manual communication and oral communication. Proponents of each position have been locked in bitter debate as to the relative value of each mode of communication, with the proponents of the oralist position dominating the administration of the education of the deaf. The manualists argue that education should include a formal language of gestures (sign communication and fingerspelling) based on the child's natural development of communicative gestures. The

oralists argue that signing should be prohibited and that all possible effort should be placed on teaching the language prevalent in the culture, orally and with auditory amplification.

Alterman concluded that critical examination of the arguments put forth by the supporters of the oralist position are based on value judgments rather than on scientifically derived information. He found no basis to the claims of the oralists that oral skills are necessary for adjustment to a hearing society, that usage of a sign language makes learning an oral language more difficult, and that early exposure of the deaf child to parental speech is beneficial.

The work of Whetnall and Fry (Fry, 1966; Whetnall & Fry, 1964) provided support for continued investigation of the ability of hearing-impaired children to acquire speech through auditory training. However, Moores (1970a), using a criterion of a loss of 75 db in the better ear over the speech frequency range as signifying deafness, claimed that none of the seven audiograms presented by Whetnall and Fry indicated deafness. Hirsh (1966) observed that each of Fry's (1966) subjects were a "good bet for speech production" in a school for the deaf. These studies certainly underline the importance of careful auditory investigation of each child and of developing individual educational programs tailored to the dimensions of the hearing loss.

Numerous studies within the past decade have attempted to evaluate and compare the oral method to the manual methods with respect to the cognitive and social development of the deaf child. Of the studies, only one showed a deficit for students having early manual training, and that was specific to the area of speech; the deaf students with manual

communication experience were superior in the areas of vocabulary, speech-reading, and overall educational achievement (Quigley, 1969; Quigley & Frisina, 1961).

Tervoort and Verbeck (1967) found no correlation between early manual training and success in speech training (no negative effect). Montgomery (1966) found that manual communication does not negatively affect speech or speechreading skills. Hestor (1963) found that manual fingerspelling deaf students were superior to an orally taught group of deaf children on standardized achievement tests. Stevenson (1964) examined the educational achievement of manual group children versus oral group children; he found the manual group superior in 90 percent of his matched pairs. In fact, 38 percent of his manual group went to college as opposed to 9 percent of the oral group. Denton (1965) studied the academic top 10 percent of deaf children at the ages of 12, 15, and 18 years from 26 different schools for the deaf. The mean achievement score for the manual group was higher than that of the oral group (8.2 vs. 7.7).

Stuckless and Birch (1966) compared 105 deaf children of deaf parents (manual group) with 337 matched deaf children of hearing parents (oral group). They found that the early manual group was better in speechreading, reading, and possibly better in psychosocial adjustment, and found no difference between the groups in speech. Meadow (1968) supported the Stuckless and Birch results and also found that the manual group scored better in mathematics, in overall educational achievement, and in social adjustment. Further, the manual group was rated higher on traits of maturity, responsibility, independence, sociability and appropriate sex-role behavior.

Vernon and Koh (1970) pointed out that the above studies were possibly confounded in that the manual-communication subjects had deaf parents while the oral-communication groups had hearing parents. In order to allow for the possibility of brain damage that is often a concomitant of deafness when both parents have normal hearing, Vernon and Koh studied a group with a family history of genetic deafness. The sample consisted of manually trained deaf children with deaf parents and oral preschool children with hearing parents who had pedigrees of genetic deafness. The two groups were matched for IQ, sex and age, and were examined on the variables of educational achievement, communication skill and psychological adjustment. Vernon and Koh found that the use of early manual communication produced better overall educational achievement including superiority in reading skills and written language.

Vernon and Koh (1971) compared the academic and linguistic skills of deaf children matched on IQ, age and sex, who had been in an oral preschool program, with two groups that had not had preschool training: deaf children of deaf parents who used manual communication, and deaf children of hearing parents (an oral environment). Those children with early manual communication and no preschool were superior both academically and in certain language skills (reading and paragraph meaning); the scores for the oral preschool children and the children from an oral environment without preschool training were approximately equal with regard to academic achievement, oral skills and written language. There were no significant differences among the three groups in speech and speechreading.

In light of the above research, it is incumbent upon educators of the deaf who utilize a strictly oral program to thoroughly reevaluate their programs.

10. A Brief Note on Personality Disorders in the Deaf

In measuring the self-attitudes of the deaf, Blanton and Nunnally (1964) found that the deaf were less positive in their evaluations than matched hearing controls and were not as good as the hearing subjects in recognizing appropriate emotions in a given situation. This inability to recognize emotions and to react appropriately in a given situation has often been judged as emotional immaturity in the deaf. Blanton and Nunnally attributed these deficiencies to the overall language deficiency-- a lack of vocabulary with which to classify emotions and to react verbally to them. Their findings were supported by Schlesinger and Meadow (1971), who reported a greater proportion of behavioral and emotional problems among deaf children than among hearing: 12 percent of the deaf children were considered to be emotionally disturbed, and an additional 20 percent were considered mildly disturbed. Emotional and psychological problems among deaf children were thus three to five times more common than among hearing children.

Stewart (1971), reporting on a summer vocational training program for multiply handicapped deaf adults, found an even larger proportion of emotional disturbance among his sample than among the deaf children whom Schlesinger and Meadow discussed. Fully 55 percent of the adults in Stewart's sample left the program for problems in behavior, disruption of classes and severe emotional immaturity.

Finally, Pintner et al. suggested from preliminary investigation that deaf children who come from homes where there are no other deaf persons are less well adjusted than those from homes where there are other deaf relatives.

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