

English in the Deaf Population

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The loss of hearing sensitivity in young children alters the character of their linguistic intake, which in turn interacts with their development and maturation and affects the acquisition of language (and speech) to the degree that many deaf children enter adolescence and adulthood without the ability to communicate effectively in English. However, not all hearing impairments have equally devastating effects on language development. Given a child with impaired hearing, the integrity of his linguistic intake, which is associated with the integrity of his sensory capabilities (e.g., the severity and configuration of his hearing loss) and physical properties of the intake itself, interacts with the progression of his cognitive development and neurological maturation (e.g., the child's age at onset of the hearing loss) to

determine, in large part, the course and extent of his linguistic growth. Therefore, some hearing impairments have little or no discernible effect on language acquisition (e.g., hearing losses occurring in the latter stages of childhood), while others almost always have a profound and lasting impact (e.g., severe congenital hearing losses). Due to the enormous range of this variation, the hearing-impaired population consists of a widely diverse and extremely heterogeneous mixture of people whose linguistic skills range from the primitive to the highly refined.

This chapter describes the major characteristics of language use, structure, and acquisition in the deaf population by reviewing and evaluating pertinent literature in the area of language and deafness. It is not intended as an exhaustive review of the literature; rather, it is designed to touch upon major works in the field, providing critical analysis of research that has been conducted and, more importantly, providing observational and descriptive data bearing on the problem

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of language and deafness (for other reviews see Swisher, 1976, Norlin and Van Tasell, 1980, Cooper and Rosenstein, 1966, and Kretschmer and Kretschmer, 1978).

In order to discuss language and deafness, however, an explicit definition of terms is necessary. Language, in this chapter, refers to English, while deafness denotes individuals with severe to profound bilateral (peripheral) hearing losses occurring before about two years of age (cf. Lenneberg, 1967). The definition of deafness extends beyond a simple audiometric classification to include chronological age, since it is the interaction of hearing loss, or more properly linguistic intake, with development and maturation that affects the use, structure, and acquisition of English. Although this definition of deafness circumscribes a subset of the hearing-impaired population (i.e., individuals with severe to profound "prelingual" hearing losses), the language characteristics of these individuals are not uniform and invariant. In other words, significant differences among the individuals who comprise the group do exist, and it is important to recognize this fact. Unless otherwise indicated, statements made in this chapter are intended as generalizations which apply to prelingually deaf individuals as a group, and such generalizations are valid descriptions of group characteristics only.

The scope of this chapter encompasses the use, structure, and acquisition of English, and the chapter is organized around these themes. An implicit distinction between linguistic ability and various domains of linguistic performance has been incorporated into the chapter for the purpose of organizing and presenting information. Linguistic ability herein refers to functional knowledge of English (i.e., observations and descriptions of language structure and linguistic competence), while performance domains denote data derived from nonlinguistic procedures (e.g., standardized tests, word counts, error taxonomies, and word associations). Although many important characteristics of the linguistic ability of the deaf are embodied in their spoken and written language performance, most research in these areas has employed procedures unable to observe or describe linguistic competence. Therefore, in order to distinguish true linguistic ability from quasi-

linguistic components of performance, separate sections have been devoted to each topic in this chapter.

In the field of linguistics, descriptions of language structure and linguistic competence are normally based on spoken rather than written discourse, since speech is the primary embodiment of natural language. However, given the function of writing in the deaf population, a function which in many ways is analogous to the role of speech in the hearing world, it appears reasonable to consider writing a primary manifestation of language in deaf individuals. In fact, data indicate that various characteristics of the spoken and written language of the deaf are correlated (Goda, 1959). These considerations eliminate the need for strictly distinguishing between spoken and written language in a general discussion of this sort, most importantly in a general discussion of linguistic ability. Moreover, certain characteristics of writing performance (e.g., simple observations of language structure) complement descriptions of linguistic ability and cannot be excluded from them.

Performance characteristics are reviewed first in this chapter, and linguistic ability is covered next, followed by a general discussion of language acquisition in deaf individuals. Finally, the chapter closes with a brief summary and concluding remarks.

PERFORMANCE CHARACTERISTICS

Reading

The reading comprehension skills of deaf children and young adults frequently have been compared to those of individuals with normal hearing, reading comprehension constituting "probably the single most critical area of school achievement for any group of children" (Trybus and Karchmer, 1977, p. 64). Comparative studies of reading performance, which may be traced back to the early part of this century (e.g., Pintner and Patterson, 1917), have typically relied on scores from standardized tests and have consistently resulted in large differences between the performance of deaf subjects and normal-hearing controls matched for age. The distressingly poor performance of deaf students on tests of reading achievement indicates that

they are at a considerable educational disadvantage, which stems primarily from linguistic deficiencies rather than from pervasive cognitive or intellectual deficits (Conrad, 1979; Furth, 1971; Moores, 1970a; Pintner and Patterson, 1916).

Test data indicate that the reading achievement of approximately half of the deaf high-school population is below that of an average 9½-year-old hearing child, in other words below a fourth-grade level (Furth, 1966; Cooper and Rosenstein, 1966; DiFrancesca, 1972; Trybus and Karchmer, 1977; Conrad, 1977). This finding has been interpreted as evidence that about half of the young deaf adult population may be considered "functionally illiterate" (Furth, 1966; Conrad, 1977). Consistent with the findings of previous research, the results of a recent comprehensive study reveal that less than 10% of the hearing-impaired 18 year olds in the United States can read at or above an eighth-grade level (Trybus and Karchmer, 1977). As a group, deaf students' average growth in reading achievement has been estimated at less than 0.3 grade equivalents/year (Trybus and Karchmer, 1977; DiFrancesca, 1972), and this growth probably subsides at the time they complete school (Hammermeister, 1971). Thus, many deaf individuals without the benefit of formal post-secondary education enter adulthood reading at or below a fourth-grade level and remain at this plateau throughout their adult lives.

The vocabulary achievement of deaf students, like their performance in the related area of reading, differs markedly from that of hearing norms, with most deaf students 18 years old and younger scoring at or below a fourth-grade level (DiFrancesca, 1972; Cooper and Rosenstein, 1966). In general, the vocabulary performance of deaf people tends to be poorer than their reading achievement, indicating that weaknesses in the area of vocabulary probably contribute to poor reading comprehension (DiFrancesca, 1972; Walter, 1978).

Although decades of research have consistently shown that the reading and vocabulary performance of deaf students is exceedingly low in comparison to that of hearing norms, the English language proficiency of these individuals is substantially lower than that of

hearing children achieving similar grade equivalent scores on standardized reading and vocabulary tests (Moores, 1970a; Walter, 1978). For example, an 18-year-old deaf student scoring at the fourth-grade level on a standardized reading or vocabulary test would tend to be less proficient in his use of English than a typical fourth grader with normal hearing. The discrepancy between the linguistic ability of deaf students and that of normal-hearing students performing at comparable grade levels stems from the fact that standardized reading and vocabulary tests measure educational achievement rather than linguistic ability per se and, in so doing, presuppose a level of linguistic proficiency which most deaf children do not possess (Moores, 1970b). The distinction between educational achievement and linguistic ability illustrates the fact that normally hearing children, unlike their deaf counterparts, develop a great deal of linguistic knowledge before reaching school age, without the benefit of formal education (Dale, 1976; Kretschmer and Kretschmer, 1978); whereas academic achievement is highly correlated with formal schooling and, in most cases, is just beginning to develop as a child enters school. Therefore, grade equivalent reading and vocabulary scores may only be considered rough, indirect estimates of the relative linguistic ability of deaf students, with this use and interpretation of achievement test scores being justified by the fact that linguistic ability is a necessary prerequisite for reading and vocabulary achievement and by the fact that reference to hearing norms is explicitly avoided by considering grade equivalent scores "relative values that show relationships between sub-groups of the (deaf) population" (DiFrancesca, 1972, p. 7).

Verbal Associations and Spelling

Word association tests and semantic differential scales, measures derived from behaviorist approaches to the psychology of language, have been administered to deaf children and young adults in attempts to provide insight into their learning of vocabulary and the organization of their lexicons (e.g., Blanton, 1968). Reminiscent of reading and vocabulary achievement data, the basic finding of these studies is that the verbal associations

of hearing-impaired subjects differ from those of individuals with normal hearing, with the word associations of deaf subjects often resembling those of younger, hearing children (Blanton, 1968; Koplin et al., 1967; Swisher, 1976). In other words, the results of verbal association studies imply that deaf and normal-hearing individuals differ with respect to the organization and acquisition of lexical information. Both sensory and learning factors (e.g., the role of audition in experiencing the universe and acquiring knowledge, and the role of formal vocabulary teaching as opposed to naturalistic verbal learning) have been mentioned as possible causes of this difference (Blanton, 1968; Nunnally and Blanton, 1966). However, word-sorting data indicate that the difference between the semantic organization of deaf and hearing adolescents is not generalized across the entire lexicon; rather, this difference appears to be limited in large part to semantic domains for which the deaf have little experience, such as words associated with auditory imagery (Tweney et al., 1975).

Unlike deaf individuals' academic achievement in the areas of reading and vocabulary, which has been shown to be severely retarded in comparison to hearing norms, their spelling achievement is relatively advanced. Data have consistently shown that within the limits of their vocabularies, the spelling performance of hearing-impaired students is superior to that of normally hearing children matched for age or reading achievement (Hoemann et al., 1976; Templin, 1948; Gates and Chase, 1926) and is also superior to their own reading achievement (DiFrancesca, 1972). This superiority has generally been attributed to the fact that hearing loss renders children less inclined to commit auditory confusion errors on spelling tasks, auditory confusions constituting the basis of most spelling errors in children with normal hearing (e.g., Read, 1975; cf. Gibson et al., 1970). Rather than using auditory (speech) coding as their primary means of representing written information in short-term memory, many deaf individuals tend to employ visual (orthographic) encoding schemes as well as coding based on the manual alphabet (Conrad, 1973; 1979; Locke and Locke, 1971). In summary, differences exist between the performance of

deaf and normal-hearing individuals on verbal association and spelling tasks, and these differences have been attributed to the effects of hearing loss on learning and information processing.

Writing

As in other performance domains, analysis of the writing of the deaf has frequently been accomplished by comparing the performance of deaf subjects and normally hearing controls along one or more dimensions. Various indices have been devised to assess both quantitative and qualitative aspects of writing performance, with most measures employing enumerative procedures, such as word counts or counts of error and sentence types. The assumptions underlying this research are that the writing performance of deaf and normal-hearing children are directly comparable and that enumerative procedures can provide insight into the use and development of written language in the deaf. Since writing may be considered a primary manifestation of linguistic competence in the deaf but may only be considered a subsidiary linguistic skill in the hearing population, and since enumerative procedures are not sensitive to linguistic ability, the validity of these assumptions is dubious; consequently, the results of this research should be interpreted cautiously. For example, although the performance of deaf teenagers resembles that of younger children with normal hearing on many numerical indices of writing performance (e.g., word counts and counts of sentence types), as has been demonstrated in comparative studies (e.g., Myklebust, 1964; Heider and Heider, 1940), the linguistic abilities of deaf teenagers are not on a par with those of normal-hearing elementary school children (Moores, 1970a). Equating the writing performance of deaf adolescents to that of normally hearing elementary school children is, therefore, a practice which should be avoided, unless clear distinctions are drawn between linguistic competence and writing performance in these two populations (see "Appendix A" to this chapter for an example of a typical composition written by a deaf adolescent).

The results of word count studies indicate that deaf children and adolescents write shorter sentences (i.e., fewer words per sen-

tence) than hearing controls at comparable ages (Heider and Heider, 1940; Myklebust, 1964), using a larger proportion of simple, one-clause sentences and a smaller proportion of multiple-clause constructions than their hearing counterparts (Heider and Heider, 1940). Clear differences between deaf and hearing children have also been observed with regard to patterns of word and phrase usage, with the deaf often repeating the same words and phrases over and over within a discourse (Heider and Heider, 1940; Simmons, 1962; Myklebust, 1964). However, on computations of the total number of words and sentences per composition, differences between deaf and hearing subjects are less definitive due to methodological differences between studies (Swisher, 1976) and to interactions between the hearing status and age of subjects (Myklebust, 1964). Furthermore, the criteria for defining and classifying sentences in writing performance have been arbitrary (e.g., Heider and Heider, 1940) and in some instances subjective and inexplicit (e.g., Myklebust, 1964). Thus, sentence counts, as well as counts of the number of words per sentence, are not as objective, reliable, and valid as they might appear to be.

Quantitative analyses of word classes in written language performance reveal that deaf individuals sometimes use more articles and nouns and fewer adverbs and conjunctions than normally hearing children matched for age, while comparative data on their use of other word classes (e.g., verbs, adjectives, and prepositions) are more problematical, since conflicting results have been reported by different researchers (compare Simmons, 1962, and Myklebust, 1964). Even these findings are mitigated by a number of considerations. Aside from methodological differences between studies (Cooper and Rosenstein, 1966), the results are tempered by interactions between the hearing status and age of subjects, which have been reported for the use of articles and prepositions (Myklebust, 1964), and, more importantly, by the fact that this research has been biased toward classifying words according to the linguistic categories of standard English, rather than nonstandard categories which might have been intended by the deaf (Cooper and Rosenstein, 1966; cf. West and Weber, 1974).

Aside from numerical data collected in comparative studies, the results of other word count research reveal that the sentence and composition length of deaf adolescents and young adults tend to increase with age, and numerical indices pertaining to the diversity of word usage also tend to increase as a function of age (Stuckless and Marks, 1966). However, grammatical errors remain numerous in the writing of deaf 18 year olds, although their number has been shown to have decreased slightly with age (Stuckless and Marks, 1966).

Perhaps the most striking characteristic of the written language of deaf individuals is the proliferation of errors or deviations from the norms of standard English grammar and usage. These errors, or "deafisms" as they are sometimes called, have been classified in terms of nonlinguistic categories of addition, substitution, omission, and order of words (Myklebust, 1964). However, the definitions of these categories have been neither precise nor objective (Cooper and Rosenstein, 1966), nor are the categories mutually exclusive, which is to say that a given error may be classified in more than one way (e.g., the error in the sentence "The dog chased the car and had a flat tire" may be classified either as an omission, omitting the subject of "had," or as a substitution, substituting "and" for a relative pronoun). Such classification schemes, which presuppose that language is simply a linear array of words, are biased toward the norms of standard English, and consequently are not able to provide insight into the phrase and clause structure intended by deaf individuals (Bochner, 1978). Therefore, nonlinguistic error taxonomies reveal more about the subjective impressions which normally hearing adult readers have of written language than they do about the performance of deaf writers.

The results of nonlinguistic error analyses provide little information about writing performance and linguistic behavior, simply indicating that the category of omission is the most frequent type of error committed by deaf children and adolescents, followed in order of decreasing frequency by the categories of substitution, addition, and word order (Myklebust, 1964). In contrast, observational data have consistently revealed perva-

sive patterns of errors in inflectional morphology (e.g., verb tense and agreement), function words (e.g., articles and prepositions), and other linguistic categories (e.g., phrase and clause structure) in the writing of the deaf (Greenberg and Withers, 1965). Such observations provide direct insight into both writing performance and linguistic ability and therefore are a potentially valuable source of information for students, teachers, and researchers.

Writing skills in deaf children also have been studied to determine the order in which sentence structures and word classes develop in written language (Walter, 1959). Consistent with the results of other research in the area of writing (Myklebust, 1964), data indicate that naming behavior (i.e., the simple juxtaposition of nouns and noun phrases) represents a primitive stage of written language development and that conjunctions and prepositions appear relatively late and are a source of great difficulty (Walter, 1955). Thus, the development of sentence structures and word classes in the written language of deaf children seems to reflect the general characteristics of their writing performance embodied in counts of words, word classes, and sentence types, and as in the area of reading comprehension, much of this development appears to reach a plateau during adolescence or shortly thereafter (Myklebust, 1964).

Spoken Language

Aside from the obvious fact that speech intelligibility is an independent (and perhaps confounding) variable which must be considered when selecting subjects, the basic procedures used in most studies of spoken language performance correspond to those employed in research on writing, and the shortcomings of these studies are identical to those of their counterparts in written language. Moreover, the results of spoken language research parallel those in the area of writing, with word and error count data indicating that deaf children, adolescents, and young adults produce fewer words (both types and tokens) overall, fewer words (types and possibly tokens) within most word classes, shorter sentences, and more errors than normally hearing controls of the same age or

younger (Brannon, 1966 and 1968; Brannon and Murray, 1966; Elliott et al., 1967; Simmons, 1962). In a related finding, hard-of-hearing children and adolescents also have been found to produce much shorter sentences than normally hearing controls (Bamford and Mentz, 1979).

The spoken language of deaf individuals seems to consist primarily of nouns and verbs, indicating a dearth of function words (Goda, 1964; Elliott et al., 1967; Brannon, 1966 and 1968). On the other hand, in what may be a contradictory finding, the use of words and word classes in spoken language seems to be more diverse than their use in writing (Simmons, 1962). Despite these seemingly disparate findings, written productions appear to be longer (i.e., having more total words and words per sentence) than their spoken counterparts (Goda, 1959). When compared to younger children with normal hearing, the overall performance of deaf children on oral language comprehension and production tasks tends to improve relatively slowly as a function of age, with verb forms constituting a major source of difficulty in spontaneous oral production (Pressnell, 1973). In conclusion, data from numerous studies indicate that the expressive language performance of deaf children, like their performance in receptive domains, differs from that of normally hearing children at the same age or younger.

LINGUISTIC ABILITY

Lexical and Morphological Knowledge

Knowledge of words and word classes in deaf children, adolescents, and young adults has been studied experimentally with sentence completion procedures. These indicate that within the limits of their vocabularies, the deaf know a good deal about the gross distributional properties of English lexical items (Odom et al., 1967; MacGinitie, 1964). However, their functional knowledge of semantic information and of finer syntactic properties of lexical items is severely limited (Walter, 1978; Odom et al., 1967). That is, deaf individuals frequently select words from appropriate syntactic categories (i.e., nouns, verbs, articles, prepositions, etc.) to complete sentences, but often choose inappropriate

words from within these categories. Therefore, they seem to exhibit a fairly well developed knowledge of category membership, but lack comparable competence with semantic information and with finer syntactic properties of words. Consistent with observations of their written and spoken language performance, these findings demonstrate that function words are a source of great difficulty for the deaf (Odom et al., 1967). In addition, their vocabularies usually are comprised of very few lexical items, being limited to a fraction of the content words acquired by normally hearing children (Walter, 1978; cf. Odom et al., 1967). Furthermore, their knowledge of even the most common content words is seriously deficient (Walter, 1978; cf. Templin, 1966), which is consistent with verbal association and reading and vocabulary achievement data.

Knowledge of various aspects of English morphology (i.e., inflectional endings on nouns and verbs and derivational suffixes) has been studied with sentence completion and comprehension techniques in research indicating that many deaf individuals have not acquired functional (productive) control of various morphological rules, especially derivational rules (Cooper, 1967). Similar procedures have been employed to assess lexical and morphological knowledge in research demonstrating that deaf children and adolescents know relatively more about content words than they do about function words and morphology (Hart and Rosenstein, 1964). Likewise, knowledge of lexical features associated with various types of pronouns (e.g., case, gender, and number features associated with personal, possessive, reflexive, and relative pronouns) has been assessed in a series of multiple-choice, sentence completion tests administered to deaf children, adolescents, and young adults, the results of which indicate that their knowledge of the English pronoun system is incomplete and that knowledge of lexical features is not additive (Wilbur et al., 1976).

Patterns of lexical and morphological errors commonly occur in the writing of deaf individuals (Greenberg and Withers, 1965), and in further research their status has been assessed and compared to knowledge of standard English sentence patterns by eliciting grammaticality judgments from deaf subjects

(Quigley et al., 1976c). Consistent with observations of their writing performance, grammaticality judgment data indicate that deaf children, adolescents, and young adults have considerable difficulty with inflectional endings on verbs, as well as with auxiliary forms and the main verbs "have" and "be" (Quigley et al., 1976a). These data also reveal that their judgments are extremely unreliable (cf. Gleitman and Gleitman, 1979). Therefore, their knowledge of lexical (auxiliary forms and the main verbs "have" and "be") and morphological (inflectional) aspects of English verb forms, while tending to increase as a function of chronological age, appears incomplete and unstable, even in young adult members of the population (Quigley et al., 1976a).

Based on observations of written utterances produced by children (Ivimey and Lachterman, 1980; Ivimey, 1976) and the results of a sentence repetition experiment conducted on adolescents (Charrow, 1974), the lexical and morphological abilities of deaf individuals have been described in studies which further document the difficulty they have with function words (especially auxiliary forms, articles, and prepositions) and inflectional morphology (especially verb endings). Since verb forms are not consistently associated with time reference in the language of many deaf children, they may not be analyzable into separate stem and tense morphemes (Ivimey and Lachterman, 1980). Moreover, data on the production of negative and interrogative sentences indicate that auxiliary forms may not comprise a functionally distinct grammatical category (i.e., a separate category of auxiliary forms may not be specifiable in grammatical rules) for many deaf children (Ivimey and Lachterman, 1980). Since these descriptions have been based on observations of utterances produced by elementary school children, they are probably indicative of a relatively early stage of language development, and hence are not likely to be completely generalizable to the population of young deaf adults. Nevertheless, to the extent they are valid descriptions of the linguistic systems of deaf children, they probably can provide insight into the language of deaf adults, especially with respect to patterns of variation between and within individuals. In addition to these descriptions, the distribution (misuse) of articles (Charrow, 1974) and

prepositions (Ivimey and Lachterman, 1980) has been found to be highly variable and not readily subject to formal analysis. Furthermore, it appears that some combinations of lexical items function as unanalyzed (or incompletely analyzed) units for many children, e.g., certain verb + preposition collocations (Ivimey and Lachterman, 1980; cf. West and Weber, 1974).

In general, deaf individuals have considerable difficulty with function words and inflectional (and derivational) morphology. Similar findings also have been reported for hard-of-hearing children in an oral recall-repetition experiment (Wilcox and Tobin, 1974) and for a young hard-of-hearing child in a description of her spontaneous oral productions (West and Weber, 1974). While many studies have located specific problem areas in standard English grammar, few have sought to describe the rules (especially non-standard rules and grammatical categorizations) and patterns of variation which characterize the attempts of hearing-impaired individuals to process and produce English. Descriptive studies of this sort can provide valuable insight into the linguistic ability of deaf people and lead to the development of improved pedagogical methods and materials.

Interrogative and Passive Constructions

The difficulties deaf children, adolescents, and young adults experience with interrogative sentences have been investigated with a grammaticality judgment procedure in research designed to assess knowledge of rules involved in the derivation of questions (Quigley et al., 1974a). This research demonstrates that their conscious knowledge of such rules as subject-auxiliary inversion, "do" support, and WH movement improves with chronological age, yet remains incomplete and somewhat unstable even in young adults. Additionally, this research demonstrates that deaf individuals of all ages exhibit a strong tendency to accept ungrammatical strings introduced by WH question words as grammatically correct interrogatives (e.g., "Who did the dog bite the girl?"), a tendency which probably occurs because such strings contain a contiguous subject-verb-object sequence.

The extent to which these findings are supported by observations of naturalistic ut-

terances is unclear at best, which weakens generalizations pertaining to functional linguistic skills and language structure (Gleitman and Gleitman, 1979; Read, 1978). Another factor tempering such generalizations is the finding that many deaf individuals often seem to comprehend questions, as evidenced by their ability to select appropriate responses on a multiple-choice question-answering task (Quigley et al., 1974a). More importantly, this research presupposes the existence of a separate grammatical category consisting of auxiliary forms. However, such a category may not exist in the language of deaf children (Ivimey and Lachterman, 1980), as noted previously. Therefore, descriptive data pertaining to the status of auxiliary forms (Ivimey and Lachterman, 1980) indicate that the structure of interrogative constructions in the language of many deaf individuals (especially children) may differ greatly from the structure of interrogatives in standard English grammar, which implies the existence of significant inter- and intra-individual variation. Although the status of auxiliary forms cannot be ascertained directly from grammaticality judgment and comprehension data for interrogative sentences, such data are completely consistent with the hypothesis that a separate and distinct category of auxiliary forms does not exist in the English of many deaf children and that such a category may only begin to emerge in a highly unstable form in older children and remain unstable in many adult members of the population.

The difficulty deaf children, adolescents, and young adults encounter with auxiliary forms also is evident in the comprehension and production of passive sentences. The results of comprehension experiments conducted in the United States (Power and Quigley, 1973) and the Netherlands (Tervoort, 1970) indicate a strong tendency to interpret passive sentences as if they were active, a tendency which diminishes as a function of chronological age, yet is not overcome even in young adults. Production data gathered in a multiple-choice, sentence completion task are consistent with this finding, indicating that deaf individuals have considerable difficulty with the lexical and morphological markers which characterize the passive construction (Power and Quigley, 1973). Furthermore, in recalling active and passive sen-

tences, deaf adolescents and young adults commit many errors, especially with function words and morphological endings (Sarachan-Deily and Love, 1974). Taken together, these data clearly demonstrate that many deaf people have a severely limited knowledge of the passive construction. Since the passive construction is associated with a set of lexical (function words, i.e., "be" and "by") and morphological (e.g., "-en") markers and since such forms in general constitute a major source of difficulty for the deaf, it is reasonable to conclude that many of their problems with passive sentences are related to a pervasive difficulty with function words and morphology, especially within the system of verb and auxiliary forms (cf. Quigley et al., 1976a).

In summary, deaf people experience considerable difficulty with interrogative and passive constructions, and this difficulty may arise in large measure because a separate grammatical category consisting of auxiliaries has not been firmly and completely established in their linguistic repertoire.

Multiple-Clause (Multiple-Verb) Sentences

The difficulty deaf children, adolescents, and young adults experience with conjoined clauses has been studied with grammaticality judgment and sentence-combining techniques (Wilbur et al., 1975), while judgmental and comprehension protocols have been employed to investigate their problems with relative clauses (Quigley et al., 1974b; cf. Davis and Blasdell, 1975), and their knowledge of complement constructions has been examined by eliciting grammaticality judgments (Quigley et al., 1976b). Consistent with observations of their naturalistic utterances (e.g., Greenberg and Withers, 1965; Heider and Heider, 1940), the results of these investigations indicate that conjunction poses the least problem for the deaf, that relativization is much more troublesome than conjunction, and that complementation presents the greatest obstacle (Quigley et al., 1976b and 1976c). Much of the difficulty deaf individuals experience with multiple-clause (multiple-verb) constructions manifests itself as a problem in correctly associating verbs with appropriate subject noun phrases in discontinuous arrangements of constituents (i.e., when verbs

and subject noun phrases are interrupted by intervening material, such as in center-embedded relative clauses, reduced conjoined clauses, and certain infinitive constructions). This problem is related to a general tendency to impose grammatical closure on any potential subject-verb-object series (i.e., on any contiguous noun-verb-noun sequence), and thereby obliterate distinctions between coordinate and subordinate clauses and active and passive sentences. In general, the difficulty deaf people experience with multiple-clause (multiple-verb) constructions appears to be a manifestation of a pervasive structural anomaly in their language, an anomaly which has been characterized as a tendency to "perceive, produce, and learn syntactic structures by arranging lexical items in a linear-sequential fashion without regard to hierarchical order and without specifying relations of subordination and superordination" (Bochner, 1978, p. 174). This anomaly is reflected in the spontaneous utterances of many deaf individuals (in an utterance such as "The man stepped on the balloon and broke" (for other examples see "Appendix B" to this chapter, Greenberg and Withers, 1965, and Heider and Heider, 1940)) and has been described in research employing judgmental procedures (Bochner, 1978). Furthermore, the description of this anomaly is supported by the results of a phrase recall experiment (Odom and Blanton, 1967), the results of experiments designed to assess the use of language describing temporal order among events (Jarvella and Lubinsky, 1975), and the results of various other studies (Quigley and King, 1980).

Although spread throughout the population, the tendency toward juxtaposing phrases and clauses in linear series is not always consistently manifested between or even within individuals. In other words, the tendency is viewed best as a means of characterizing inter- and intra-individual variation, and in this regard it is possible that under certain circumstances even words may be arranged in linear series without being grouped into constituent units or chunks (e.g., in the early stages of language acquisition, some deaf children exhibit primitive naming behaviors in which nouns are simply listed or juxtaposed in serial order). Unlike the simple juxtaposition of phrases and clauses, a tendency to arrange words in serial order has yet

to receive sufficient empirical support to be accepted as a general principle. However, the existence of such a tendency is supported tentatively by the general difficulty the deaf experience with function words and by data indicating that phrase structure does not facilitate word recall in many deaf individuals (Odom and Blanton, 1967). Again, should a tendency to arrange words in serial order exist, it would do so only under certain restricted circumstances, and hence could be considered only as a possible means of describing linguistic variation in the deaf population.

As might be expected, the problems deaf individuals encounter with multiple-clause constructions are related to the pervasive difficulty they experience with function words, such as relative pronouns, conjunctions, and complementizers. For example, certain subordinate clause markers (e.g., "that" and "because") may tend to function as coordinating conjunctions in the language of many deaf people, which is consistent with the notion that phrases and clauses are often arranged in linear (serial) order (Bochner, 1978). In a related area, specifying the reference of nouns and noun phrases appearing in a discourse is a serious problem for many deaf individuals, a problem which typically manifests itself as a chronic misuse of articles but also may involve the misuse of pronouns and the apparent omission of coreferential nouns and noun phrases (Wilbur, 1977; e.g., Greenberg and Withers, 1965). Therefore, in addition to posing a problem for the arrangement of phrases and clauses, the misuse of function words poses a problem for indicating the reference of nouns and noun phrases in discourse as well.

In summary, deaf individuals experience considerable difficulty with multiple-clause (multiple-verb) constructions, exhibiting a general tendency to impose grammatical closure on any contiguous noun-verb-noun sequence. This tendency is related to a grammatical anomaly characterized by the linear (serial) arrangement of phrases and clauses and the misuse of function words.

LANGUAGE ACQUISITION

As noted in the introductory portion of this chapter, primary language development is

influenced greatly by the interaction between sensory capabilities and maturation of the central nervous system (cf. Lenneberg, 1967). Sensory mechanisms transmit linguistic information to the brain, information which stimulates and serves as a model for language development. In general, the linguistic information reaching the brain, linguistic intake, is limited by sensory capabilities (channel capacities and physical characteristics of linguistic signals), while the plasticity of the central nervous system is limited by maturation (chronological age), and these limiting factors interact to determine the fundamental course and extent of language acquisition in deaf individuals. Implicit in this scheme is the notion that upon reaching the brain, linguistic intake is processed by an intact central mechanism, a mechanism which presumably is unaffected by peripheral hearing loss.

Despite the use of amplification and exposure to visual representations of linguistic information (e.g., articulatory gestures, print, and manual codes), the linguistic intake of the deaf child generally remains impoverished, deformed, and incomplete (cf. Grewel, 1963, and Liberman, 1974). Hearing aids cannot compensate completely for hearing losses, since they only are able to make selected portions of the speech spectrum audible in a given ear (Niemoeller, 1978). Even with the benefits of amplification, the signal reaching the brain is imperfect in one way or another. Likewise, visual representations of linguistic information differ in many important respects from natural auditory representations. For example, many articulatory movements are not visible, and hence cannot be perceived in speechreading (Perry and Silverman, 1978). Furthermore, conventional orthography differs from speech in that much of the nonsegmental information represented in the speech signal (e.g., intonation, rhythm, duration) is not preserved in orthography (Fries, 1963), and such information may be extremely important for the perceptual segmentation (chunking) of the signal into constituent units during language acquisition (Crystal, 1973; cf. Lashley, 1951, Lenneberg, 1967, Lieberman, 1967, Martin, 1972, Svensson, 1974, and Nooteboom et al., 1978). In addition, many important features of spoken language often are not represented clearly and consistently in the performance of manually

coded English; e.g., inflectional endings and function words often are omitted in the production of signs and fingerspelling, whether by accident or by design, and prosodic aspects of speech, such as rhythm, rate, pause, and intonation, are not always preserved in manual signals. Therefore, due to limitations inherent in the sensory mechanisms themselves and in the information they process, the quality and quantity of the linguistic intake of most deaf children are sorely deficient, which probably causes their linguistic percepts to be vastly different from those of normal-hearing children.

A child's knowledge and experience of the environment depend crucially on the integrity of his sensory mechanisms, since these mechanisms serve as channels for the transmission of environmental information to the brain. When conceived in this fashion, hearing loss represents a deficiency in the intake of environmental information (especially linguistic information), and the interaction between sensory capabilities and maturation of the central nervous system may be construed as a classical interaction between environmental and biological variables. The effects of this interaction are illustrated graphically in laboratory experiments in which certain species of birds (e.g., male white-crowned sparrows) are surgically deafened early in life, before their characteristic song patterns have been acquired. Deprived of an external model on which to base their vocalizations and also of auditory feedback of their own voices (i.e., deprived of environmental stimulation and feedback), these birds acquire highly abnormal song patterns in which all species-specific characteristics are lost (Marler, 1975; Nooteboom, 1975). Such experiments illustrate that the intake of environmental information consists of both external models and feedback from one's own productions. Linguistic feedback is therefore considered an important aspect of the language intake of the deaf (cf. Myklebust, 1964), which implies that the learner's productions play an important role in language development (Chapman and Miller, 1975; Clark, 1978). In summary, laboratory experiments conducted on birds clearly have shown that the devastating effects of deafness on normal development are a product of the interaction between biological (age) and environmental (intake) vari-

ables, an interaction in which selected intake activates innate mechanisms at appropriate maturational stages and guides the development of species-specific behaviors and abilities.

A child's age at onset of deafness is the critical biological variable affecting language development, while the quality and quantity of linguistic intake, as well as the reception of linguistic feedback, are the crucial environmental variables. In addition to these primary variables, there are a number of secondary factors which collectively seem to affect language development in very modest ways. These secondary factors are mostly sociolinguistic and affective in nature, although some are related to aspects of cognition and/or correlated with the integrity of linguistic intake. The effects of one such secondary variable, the hearing status of the deaf child's parents, has been examined in studies which indicate that deaf offspring of deaf parents perform slightly better on reading comprehension tests and other indices of performance than deaf offspring of normally hearing parents (Corson, 1973; cf. Quigley, 1979, Brasel and Quigley, 1977, Vernon and Koh, 1970, and Stuckless and Birch, 1966). Other secondary variables include the nature of the deaf child's sociolinguistic contact with the hearing world (cf. Quigley, 1979), his cognitive/learning style (Parasnis and Long, 1979), and the methods, materials, and extent of his communication instruction (Kretschmer and Kretschmer, 1978; Moores, 1978).

The fact that language development in the deaf population is influenced primarily by an interaction (i.e., the interaction between biological and environmental factors) allows for the possibility of enormous individual variation in linguistic ability, variation which presumably correlates most with changes in the primary variables and least with changes in secondary variables. The range of linguistic diversity found in the deaf population probably exceeds that found in any subgroup of the normally hearing population, with individual differences in the use, structure, and acquisition of English presumably stemming from differences in one or both of the primary variables. Clearly, the biological variable, age at onset of deafness, plays a major role; moreover, it can be defined easily and objectively, and its effects are directly observable. Unfor-

tunately, the environmental variable, the quality and quantity of linguistic intake and the reception of feedback, is not as readily definable or measurable, making its effects difficult to isolate and observe. However, certain intake factors (e.g., certain nonsegmental aspects of the speech signal) may be physically altered in order to serve as independent variables in perception/comprehension experiments conducted on normally hearing children, thereby permitting these factors to be isolated and defined, and their effects observed, at least indirectly, with respect to normal language acquisition. Given the nature of the interaction between the primary variables, the deaf child's chances for becoming a competent user of the English language in adulthood depend critically on the integrity of linguistic intake occurring in the preschool years (i.e., before approximately five years of age). In other words, the probability for normal or nearly normal language acquisition appears to increase in proportion to the integrity of early (preschool) linguistic intake, which implies that the most crucial period for primary language acquisition occurs from birth through about five years of age.

The process of language acquisition in the deaf population has been compared both to normal first-language acquisition in hearing children (Myklebust, 1964; Quigley et al., 1976c; Kretschmer and Kretschmer, 1978) and to second-language learning in children and adults (Pintner and Patterson, 1916; Cicourel and Boese, 1972; Charrow and Fletcher, 1973; Goldberg and Boardman, 1974). The latter comparisons generally have presupposed that first- and second-language acquisition are vastly different processes. However, these processes are remarkably similar in a number of important respects, most of which are related to the appearance of learner errors, such as overgeneralizations (Dulay and Burt, 1974 and 1976). Therefore, it is not surprising to discover that language development in the deaf shares many similarities with that occurring in other populations, most notably in first- and second-language learners (Quigley and King, 1980).

Perhaps the major difference between successful first- and second-language acquisition pertains to the lability of learner error patterns, and hence to the plasticity of the

learner's linguistic competence. Although errors (e.g., overgeneralizations) occur naturally in both first- and second-language acquisition (Dulay and Burt, 1974 and 1976; Dale, 1976), certain of these commonly persist and become entrenched ("fossilized") in second-language learning (Selinker, 1972; Selinker et al., 1975), while this is not the case for normally hearing children acquiring their primary language(s), in which case all error patterns are extremely plastic (Dale, 1976). In second-language learning, it has been hypothesized that errors which can seriously inhibit comprehension (i.e., "global" mistakes) are more labile and amenable to correction than those which do not (i.e., "local" mistakes) (Burt and Kilparsky, 1975). However, both types of errors (i.e., global and local mistakes) persist in the English of many deaf individuals and resist correction by conventional pedagogical techniques used in deaf education (Greenberg and Withers, 1965; Quigley and King, 1980). For example, errors affecting the ordering of constituents, such as those involved in processing and producing passive sentences (Power and Quigley, 1973; Greenberg and Withers, 1965), and errors in clause structure, such as those pertaining to the distinction between coordinate and subordinate constructions (Bochner, 1978; Greenberg and Withers, 1965 (see "Appendix B" to this chapter for examples of such errors)), can seriously impede comprehension (i.e., they are global mistakes), yet they persist in many deaf learners despite years of instruction. In second-language learners, such errors are not thought to be nearly as persistent and resistant to correction (Burt and Kilparsky, 1975). However, this hypothesis is somewhat tenuous, since it has yet to receive sufficient empirical support to be accepted as a general principle. Language acquisition in a large segment of the deaf population, then, appears to differ from that occurring in *both* successful first- and second-language learners in at least one very important respect, the persistence of major structural and processing anomalies (i.e., global mistakes) and their resistance to correction by conventional means.

Despite indications that the linguistic competence of many deaf individuals may become suppressed or plateau at levels well

below those attained by successful first- and second-language learners (Myklebust, 1964; cf. Bamford and Mentz, 1979), it has been maintained that the only significant characteristic separating language development in the deaf from that occurring in other populations (especially in normally hearing children) is that their rate of acquisition is much slower (Quigley and King, 1980; Quigley et al., 1976c). These two viewpoints, which may be termed the suppression and rate hypotheses, are not compatible. The suppression hypothesis proposes that the primary interaction between biological (age) and environmental (intake) variables can suppress *both* the rate *and* extent of acquisition, and hence can limit the level of linguistic competence attainable by deaf individuals in adulthood. The rate hypothesis, on the other hand, proposes that the extent of linguistic growth is not limited in any way and therefore predicts that deaf adults eventually will develop mature competence if they are given enough time to compensate for their slow rate of acquisition. The pervasive nature of the errors occurring in the English of the deaf, as well as general characteristics of their linguistic ability and performance outlined earlier in this chapter, indicate that the level of linguistic competence in many deaf individuals is suppressed to the point where progress toward the attainment of mature competence is not simply slow but is limited in an absolute sense to levels well below those attainable by normal first- and second-language learners. Thus, the suppression hypothesis appears preferable to its alternative.

The slow rate and eventual suppression of language development in deaf individuals are thought to stem from the fact that the potential for primary language acquisition diminishes quite dramatically as a function of chronological age (Lenneberg, 1967), which implies that intake (environmental) deficits in early life cannot be completely compensated for in adulthood. Therefore, as stated earlier, the integrity of linguistic intake in the preschool years appears to be the primary factor responsible for suppressing language development in the deaf population.

In summary, the persistence of major structural and processing anomalies and their resistance to correction by conventional meth-

ods indicate that language development in many deaf individuals probably is not equivalent to that occurring in either successful first- or second-language learners, this lack of equivalence being associated with the notion that error patterns and linguistic competence are less labile (less plastic) in the deaf than they are in other language-learning populations. Moreover, the pervasive nature of error patterns in general indicates that the rate and extent of language acquisition in many deaf individuals are radically depressed, owing primarily to an interaction between biological (age) and environmental (intake) variables. In short, the effects of deafness on language development cannot be construed simply as a retardation in the rate of acquisition but may be conceived in terms of a generalized suppression of language acquisition and linguistic competence.

SUMMARY

The foregoing discussion has characterized the devastating effects of deafness on the use, structure, and acquisition of English, evaluated research in the area of language and deafness, and defined variables thought to affect language development in hearing-impaired individuals. A conclusion to be drawn from this discussion is that deafness usually imposes severe communicative and educational handicaps on children, handicaps which rarely are overcome completely. Unfortunately, the prospects for eradicating these disabilities are not particularly good (cf. Moores, 1970b). However, the prospects for lessening the communicative and educational deficits of ever greater numbers of deaf children are much better. In other words, a realistic appraisal of the enormous magnitude of the problem of language and deafness in all of its manifestations leads to the inevitable conclusion that communicative and educational barriers cannot be removed completely from the paths of all deaf children in the foreseeable future. However, the prospects for lowering these barriers are steadily improving, and it is reasonable to expect ever-increasing numbers of deaf individuals to enter or move closer to the mainstream of society as our knowledge of the problem of language and deafness advances and as our

commitment to the education of deaf children and young adults increases.

Research in the area of language and deafness can contribute much to our knowledge of the role played by environmental (linguistic intake and feedback) factors in language acquisition and also can contribute significantly to the education of the deaf. Three lines of research appear most promising. In one, explicit unbiased descriptions of the language structure (linguistic ability) of deaf individuals at various stages of development (i.e., children, adolescents, and adults) need to be formulated, and any unique aspects of their grammars characterized. Such descriptions should, in principle, attempt to characterize linguistic variation between and within individuals and/or subgroups of the population. In another avenue of research, specific environmental factors (i.e., factors which characterize the quality and quantity of linguistic intake and feedback) need to be precisely defined and their effects estimated. In the third area, the potential for developing new pedagogical techniques and technologies which would compensate for intake deficits and/or facilitate language acquisition needs to be explored. The pursuit of such research promises to enhance our knowledge and thereby contribute to lessening communicative and educational handicaps in larger numbers of deaf children and young adults.

APPENDIX A

Composition of a Deaf 14 Year Old Judged "Average" for That Age by Teacher Judgment²

They packed for going to the picnic outside. The little boy wanting to bring our dog. But her mother said to him, "Yes, you can bring our dog in picnic. Then they went with the dog. The dog bark about 3 or 4 time. he excited to go with us. They went out the car. They play baseball. Then they are ready to eat their picnic. They ate sandwishes. They drink their tea or peinch. Her Mother were cooked their hammers with the breads. They have fun to ate their food. They enjoy to have

² Reproduced with permission from E.R. Stuckless and C.H. Marks, *Assessment of the Written Language of Deaf Students*, 1966.

fun to ate their picnic. They like to have a wonderful picnic. Their dog were excited to have fun to play baseball. The dog try to catch softball. The little girl named is Nancy. The little boy name is Jerry. His Father name is Dale Her Mother name is Freda.

APPENDIX B

Composition of a Young Deaf Adult Exhibiting Confusion between Dependent and Independent Clauses

There was a man named Mr. Koumal which he tried to kill himself. Whenever he thought of some ways to kill himself but he failed. First of all he was drinking that made him to do something foolishly. He tried to shoot but no bullet came out. Then he thought of another way. Later he put a nail in the wall which it was for hanging. But everything he did was wrong. Another idea came up, so then he jumped out of the bridge but a boat moved along that saved his life. He was so desperate that another man robbed him. Somehow after the rob man left which he didn't kill Mr. Kouman. Somehow and somewhat that made him to changed his mind not to commit suicide. He wanted to live and he loved his life and the nature.

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