# 9 Review of the literature: intellectual and language issues

## Methodological issues

It is unfortunate that the main conclusion to be drawn from a survey of the rapidly expanding literature concerning the cognitive development of deaf children is the apparent contradiction of many of the research findings; instead of the emergence of an incontrovertible body of knowledge many of the issues are still in dispute. Analysis of the methods of the studies reveals four possible reasons for these contradictory findings. First, most research has been conducted on highly selected clinical samples. Second, there has been little attempt to control for differences between hearing-impaired and control samples so that often it is not clear whether the differences found between the groups are determined by deafness or, for example, by social class differences between the groups. Third, it is essential to ensure that there are not wide differences of mean age of the groups that are being studied or of the samples of the different studies that are being reviewed. For instance, there is evidence that at younger age ranges deaf subjects may perform more poorly than their hearing counterparts on certain cognitive tests, but when the same deaf children are older one may observe a 'catching-up' phenomenon (Doehring and Rosenstein, 1960; Ross, 1966; Myklebust, 1964). Fourth, there is the task of finding or devising tests that can separately, reliably and validly tap intelligence and language. Ideally, such measures should be standardized on both the deaf and hearing subjects. In fact, the majority of tests which have been used on the hearing-impaired have been devised for the hearing, with less than a dozen tests specifically standardized on the hearing-impaired being found after an extensive search (Levine, 1971). Thus research workers wishing to study the special cognitive skills of the hearing-impaired have little alternative but to rely on measures standardized for the hearing, doing their best to select those tests

considered to be least unfair to a hearing-impaired sample. Of course, such tests fall almost exclusively into the non-verbal category.

## The relationship between language and intellectual processes in the deaf

### *The controversy: the independence or interdependence of language and thought*

A major controversy among those studying deafness is whether language development is dependent on intellectual development or whether intellectual development is dependent on language. The main proponent of the view that intellectual development can proceed independently of language is Furth (1964, 1966a, 1971). The title of Furth's major work, *Thinking Without Language* (1966a), epitomizes that view. He argues that the effects of language deprivation on the deaf child's cognitive development are indirect and that adverse influences operate through impaired intellectual stimulation and motivation rather than through language deprivation. In other words, Furth models his arguments on Piaget's theory (1952, 1963, 1967) in which the acquisition of language is seen as a normal by-product of intellectual growth and as a contemporaneous form of symbolic behaviour in the child. For Furth then, language acquisition is simply a means for expressing what is arrived at independently; it is not a factor upon which thought is dependent.

In opposition to Furth there is the somewhat more popular view put forward, for example, by Lewis (1968). This is, that language and thought are complexly interrelated, and that if language development has not been allowed to take its normal course then the child's cognitive and learning development will be fundamentally affected. Such a viewpoint takes greater account of the social significance of language behaviour, which is regarded as an important source of intellectual stimulation, and of the effect it has in exercising the child's thinking processes (Luria, 1961). According to this viewpoint, the deaf child's cognitive impairment is intricately associated with the extent to which he has acquired language skills for the purpose of perceiving, understanding and describing his world.

### *The intellectual processes of the deaf*

A variation on the theme of the controversial subject of the relationship between language and thought concerns the thinking processes of the

deaf. Myklebust (1964) believes that the child who is deaf from infancy does not have the opportunity to develop fully his auditory modality and hence his perceptual processes may be established and structured differently from those of the hearing child. On the other hand, Furth (1964, 1966a, 1971) argues that the thinking processes of the deaf are similar to those of hearing subjects but that the outcome of these processes must be explained without recourse to language processes. Both of these viewpoints play down the importance of spoken aspects of language in the thinking of the deaf. Others are less convinced of the independence of intellectual processes; they emphasize the important contribution of symbolization, particularly in the sphere of language, which is considered to influence intellectual functioning (McCarthy, 1954; Whorf, 1965), even of the deaf (Lewis, 1968). Lewis (1968) points out that, while in certain circumstances deaf children may think with little or no use of language (as shown by their similar achievements to hearing children on a wide range of non-verbal cognitive tasks), in other circumstances the performance of the deaf on a range of verbal and other cognitive tasks is impaired by their inadequacy of language.

Finally, it is possible that different groups of deaf children may resort to different strategies for solving cognitive problems according to their environmental conditioning at home and at school. We can only speculate about the extent to which verbal and non-verbal symbolization contributes to the solution of any individual task. Our review of the literature leads us to conclude with other workers (Lewis, 1968; Meadow, 1975) that Furth's main hypothesis is inadequately supported not only by the work of others but also by his own data.

### *The importance of the environment: deaf and hearing parents*

The prevalence of deaf children born to parents who are themselves deaf is usually under 10% (Rainer *et al.*, 1969). Despite the smaller numbers in the deaf-child/deaf-parent category, comparisons of this group with the deaf-child/hearing-parent category provide an opportunity for studying the importance of the family environment.

On first principles, one could assume that deaf children of deaf parents would be at a disadvantage because of the relatively limited language resources and relative poverty of communication which might be encountered, and also because of the poorer school experiences and occupational levels achieved by deaf parents (Rainer *et al.*, 1969). However, such theoretical assumptions are quite the opposite of what has been found in empirical research. For instance, Stuckless and Birch (1966) compared deaf pupils of deaf parents with a group of deaf pupils of hearing parents matched on age, sex, intelligence and degree of

hearing impairment. The educational achievements proved superior in the case of deaf children with deaf parents. Such findings have been confirmed in other studies (Vernon and Koh, 1970, 1971; Meadow, 1968). Furthermore, they suggest that children exposed to sign language by their deaf parents very early in life, have benefited from early and systematic communication with their parents and that gains achieved through these techniques do not 'wash out' (Vernon and Koh, 1971). Apparently, these advantages occur despite the fact that deaf children of hearing parents are more likely to have exposure to pre-school nursery experiences and the opportunity for training in oral communication. The differences in educational achievement between these two groups of deaf children seem to rest on the fact that deaf parents use mainly manual communication whereas hearing parents favour oral communication.

The hypothesis put forward by some authors (Vernon and Koh, 1971) is that early manual communication is more efficient than early oral communication. This is abundantly supported by empirical research. Perhaps one of the reasons for this is that early manual communication may stimulate a form of early language development which may be more meaningful to the deaf child and appropriate to his needs, whereas in certain cases oral communication may be focusing on speech and its mechanical elements rather than on the symbolic aspects of language. More recently, Vernon (1976) has examined the controversy of oral only as compared to a combined manual and oral approach taking into account both theoretical issues and research evidence. He asserts that there are currently no advocates of the manual approach alone whereas there are still some who insist on using oral communication alone. From this review he concludes that there is strong evidence that 'total communication', consisting of combinations of oral and manual approaches and auditory amplification, that a deaf child is capable of using or profiting from, constitutes the most effective way of helping deaf children to cope with formal education, achieve satisfactory communication with their family and to adjust socially and to prepare themselves for employment. Perhaps the most telling point he makes is that it is time for the professional community to place the welfare of deaf children ahead of its personal philosophies of educational management.

## Language development in deaf children

It is beyond the scope of this book to provide a comprehensive review of the complex theoretical issues concerning speech and language development in deaf children (Moores, 1972; Bellugi and Klima, 1972; Meadow, 1975; Brennan, 1976). Furthermore, as Moores (1972) has

pointed out, the emergent controversies, some of which we touched on above, have often drained the energies of even the most gifted educators and researchers. In these circumstances, we decided not to be drawn into this debate and instead to confine ourselves to those basic issues immediately relevant to our research.

Moores (1972) points out that in deaf children, particularly those with profound hearing loss, the development of language is not only a different but also a more conscious and laborious procedure in which there is a heavy reliance on the visual modality. For such reasons, language acquisition of the deaf children differs qualitatively and quantitatively from the language acquisition in the hearing children. A similar view is advanced by Meadow (1975), who not only draws attention to the importance of recognizing the 'atypical' way in which deaf children acquire speech and language, but also points out that language acquisition may differ for different deaf groups according to the modes of communication used by their caretakers. She describes three main groups: (a) where (deaf) parents predominantly use sign language as a means of communicating with their deaf child; (b) where (hearing or deaf) parents simultaneously use sign and spoken English as a means of communicating with their deaf child; and (c) where (hearing) parents use spoken English as the sole means of communicating. However, even in the latter group the deaf children are subsequently likely to be exposed to peers who use sign language and so come to approximate the second group.

In the case of children with normal hearing, researchers have emphasized the importance and usefulness of internal speech in relation to the development of cognitive processes (Luria, 1961; Vygotsky, 1962; Joynt and Cambourne, 1968; Schubert, 1969). Conrad (1976) in turn poses the question of what occurs in the case of deaf children, especially those who are concurrently learning two modes of the same language, namely, speech and a sign mode? Do these children develop internal language in both modes? And if so, does the one mode help or hinder the other? Or do they develop internal language in terms of one mode only, and, if so, which one?

Meadow (1975) points out that the difficulties of language acquisition which the deaf children encounter include inner language abilities as well as the more superficial oral language skills such as speech and speech reading. Nevertheless, there is evidence that language rules are learned by deaf children in their early years and also that these rules are similar to those learned by hearing children. Furthermore, despite the method of language acquisition being different in deaf children, the vocabulary growth, grammatical complexity and syntactical structure of the language of deaf children progresses in the same way as hearing children, although such progress occurs at a slower rate in the case of

the deaf (Bellugi and Klima, 1972; Meadow, 1975).

Some researchers speculate that there may be a 'sensitive period' for optimal acquisition of speech and language and that this broadly covers the first four years of life, which is when important maturational processes of a structural, biochemical and neurophysiological kind are occurring in the brain (Lenneberg, 1967; Sloan, 1967). The 'sensitive period' roughly coincides with the period of maximal rate of vocabulary growth (McCarthy, 1954) and the mastering of the fundamentals of the complex syntactical structures of language (Menyuk, 1969; Dale, 1972). Hence the concept of a 'sensitive period' implies that it is more difficult for the child to 'catch up' in those areas of language development in which he has not already achieved an appropriate degree of competence (Fry, 1966; Illingworth, 1967; Lenneberg, 1967; Meadow, 1975). For these reasons most educators attach considerable importance to general stimulation and teaching of language from the earliest years (Fry, 1966; Bellugi and Klima, 1972; Meadow, 1975; Brennan, 1976) and to the early and proper use of hearing aids (Whetnall and Fry, 1964; Fry, 1966; Reed, 1970).

Many of the above questions and arguments are academic in relation to our own research, as we had no way of reliably knowing what system of communication the deaf children were exposed to in their formative years, and, furthermore, only one of the children had deaf parents. However, our impression was that most of the children in our study did not have access to a formal sign language system in their early years of life, but that subsequently through their teachers and/or their peers such a system became a major part of their communication. As we can only speculate about the nature of the 'first language' (Meadow, 1975) of the deaf children in our study it would seem unwise to try and relate their early communication and language experiences to their later language development. All we can do is to provide a limited picture of their current language achievement.

The tests which we have used in our study on the deaf sample are standardized and the reasons for using them will be discussed below. It is necessary again to emphasize that, with one exception, the tests used did not require verbal responses for successful completion. Every effort was made to ensure that each child adequately understood the test instructions. The instructions were conveyed to the child by combinations of speech, gesture and pantomime according to the needs of the particular child.

## Cognitive development

### *Introduction*

The review of the literature that we provide below is based on research which often fails to take into account two important points. The first is that deaf children who are being tested cannot adequately use English and that the testers usually cannot adequately use sign language. The second is that tests which have been specifically standardized on hearing groups are used for comparing deaf and hearing children. The broad implication, therefore, is that cognitive studies of deaf children are open to criticisms which are similar to those about cross-cultural comparisons. In short, the criticisms concern the use of tests which may be biased in favour of one group as compared to another.

While some may argue that such tests may be unfair to the non-hearing population, the only practical way of delineating the cognitive deficits of groups of handicapped children at the time this study was undertaken was by comparing them with control groups on tests standardized for normal children. Vernon (1969) makes an important point regarding cross-cultural studies which applies equally to studies involving comparisons between hearing and deaf groups. He says 'the main problem in testing groups with diverse backgrounds is, not to find a culturally unbiased test, which is impossible, but to find tests from which safer inferences can be drawn.' We have attempted to take this message into account both in reviewing the research literature and in the tests used in our own study. We have as far as possible confined ourselves to a range of tests which are not dependent on the modality in which the children are handicapped and which allow for their successful completion.

### *Verbal and non-verbal abilities*

The most consistent finding in research on the deaf is that their mean verbal IQ is usually significantly below that of their hearing counterparts. However, in terms of non-verbal IQ, the mean scores of groups of deaf children lie within the normal range but tend to be slightly below average (Murphy, 1957; Vernon, 1968; Wiley, 1971; Myklebust, 1964). A characteristic picture has emerged in different studies of differences between verbal and performance scale IQs of hearing-impaired children, with better results on the performance scale—such as that of Hine (1970) who examined a representative sample comprising 100 partially deaf children, aged 8–16 years, on the WISC. The mean verbal IQ proved to be 82 and the mean performance IQ 98.

There is also evidence that the intelligence of deaf children is not static and their IQ tends to become normal with age. From an analysis of the test results of the Wechsler Bellevue Scale, Myklebust (1964) reports that, from the ages 14–20, both the verbal and the performance IQs of deaf children have improved. Furthermore, by the age of 20 the children's better scores on the performance scale had compensated for the poorer scores on the verbal scale sufficiently to raise their global score to near normal. Lewis (1968) infers from this that the intelligence of the deaf tends to be retarded in its development rather than permanently impaired.

Although it is likely that the more adversely affected the child's hearing, the greater will be his disability in dealing with verbal tests, this does not necessarily mean that there is a simple linear relationship between audiometrically measured hearing loss and verbal IQ (Lewis, 1968). Indeed, verbal achievement is influenced by other factors, such as educational influences in the home and school, in addition to auditory impairment and, as Meadow (1975) has argued, the fundamental handicap of the deaf is not of hearing but rather of language. Nevertheless, in general it is evident that hearing loss impedes the child from scoring as high on verbal as on non-verbal tests.

### *Specific disabilities*

In this section we turn our attention to various specific types of cognitive functioning in which deaf children are alleged to show impairment. This is a complex area where precise definitions and sharp psychometric tools are not readily available. The situation is complicated by the fact that we are dealing with maturing processes and their organization, and these are continuously being influenced and modified by experience. In an attempt to bring some order into this rather untidy area some researchers have elected to use models of intelligence to explain the wealth of findings of cognitive impairment of the deaf. The best known of these is Myklebust (1964) who attempts, by a *tour de force*, to explain his findings as well as those of others in terms of Guilford's (1959) theoretical model of intelligence, by focusing on Guilford's five types of mental operations, namely, cognition, memory, convergent and divergent thinking and evaluation.

Although Myklebust's approach is interesting it has some serious theoretical limitations which are beyond the scope of this chapter. We have therefore preferred to consider a number of more conventional concepts in relation to the cognitive abilities of the deaf and without being tied to any theoretical model. We will concentrate, therefore, on the specific abilities of memory, perception and conceptual thinking.

*Memory*

There is some evidence (Levine, 1963; Lewis, 1968; Furth, 1971) that even where deaf and hearing children have been matched on factors such as age, non-verbal IQ and social class, the deaf tend to perform worse on certain tests. For example, it has been found that the deaf are less successful than their hearing counterparts with certain types of memory span. Withrow (1968) reports poorer visual memory for successively presented sequences of stimulus material though not for simultaneously presented sequences. Similarly, Goetzinger and Huber (1964) found that deaf children had poorer delayed recall but similar immediate recall when compared with hearing children. In a study by McCarthy and Marshall (1969), in which a deaf and a hearing group were compared with regard to visual recall of objects placed to the right and left according to a particular order, the deaf children did significantly worse. On the other hand, Blair (1947) found that on the Knox Cube Test for visual memory span the deaf performed significantly better than their hearing peers. In a cross-sectional study by Furth (1961), the visual memory of deaf and hearing subjects in two ranges, 7–10 years and 11–12 years, was tested. There were no significant differences between the deaf and hearing in the 7–10 year age range, but in the 11–12 year range the hearing children were markedly better. Furth suggests that the inferiority of the older deaf children might be attributed to a deficiency in training and experience. Conrad (1973) raises the possibility of other even more complex determinants which involve the question of different coding strategies. He found that in a group of deaf subjects who were all prelingually deaf some scored better than a hearing group on a test of short-term memory. The evidence showed that this subgroup of deaf subjects used a speech coding strategy in contrast to the visual coding strategy which is predominantly used by most deaf subjects.

Clearly, some of the findings on memory are contradictory. Whether factors such as experience and training, or perhaps age or a particular type of coding strategy constitute the important determining influence on the findings is difficult to say. A longitudinal, as opposed to a cross-sectional approach to the study of memory impairment of the deaf might possibly provide a clearer picture.

*Perception*

In other studies in which tests of visual perception have been used it has again been found that the deaf do worse than their hearing peers on some tests but not on others. For instance, Myklebust and Brutten (1953) compared a deaf and a hearing group on tests of pattern discrimination and pattern recognition and found that the performance of the deaf was

significantly poorer than that of the hearing children. Carrier (1961), on the other hand, observed no significant difference between a deaf and a hearing group on a test where they had to associate colours with weights. Such studies are relevant to a debate of whether deaf children compensate for their impaired auditory sense modality by utilizing other sensory modalities. Investigations of the ability of deaf and hearing children to use tactile cues have often proved contradicatory. In a study by Schiff and Dytell (1971) it was found that deaf and hearing children did not significantly differ in their ability to identify letters by touch. Blank and Bridger (1966) also found no significant differences between a deaf and a hearing group on a cross-modal task. However, Larr (1956) compared deaf and hearing subjects on the Marble Board Test, a picture test and a tactile motor test and found that the deaf were better than or equal to their hearing peers.

*Conceptual thinking*

Studies of the conceptual thinking of the deaf have been more challenging, mainly because of the difficulty of finding or devising tests which are appropriate and valid. Nevertheless, there are studies which have highlighted some important relevant factors.

First, it should be emphasized that while perceptual and conceptual abilities inevitably overlap, it is nevertheless important for practical purposes to attempt to distinguish between them. One important difference is the degree to which abstract symbolic thinking is necessary to cope with the test; tests of conceptual ability tend to be typified by the greater degree of abstract/symbolic thinking (Rosenstein, 1961; Pettifor, 1968).

Pettifor (1968) compared the conceptual ability of 59 'hard-of-hearing' and 59 normal hearing children (matched for sex and age and with similar mean IQs) by a sorting test which required cards to be grouped according to certain similarities or differences. The performance of the 'hard-of-hearing' group proved significantly poorer and resembled that of younger normal children. A number of investigations have been carried out by Furth and his colleagues in which Piaget-type tests have been used to study the conceptual ability of the deaf (Furth and Youniss, 1965; Youniss and Furth, 1969). In one of these studies (Furth and Youniss, 1969) a group of deaf adolescent boys of above-average IQ (Wechsler performance IQ range 111–125; age range 13–19 years) were each tested on six individual non-verbal Piaget-type tasks which involved the principles of 'formal operations' (for example, judgement of displaced volume; probability, judgement of three-dimensional space, etc.). Furth and Youniss found that none of the deaf subjects succeeded consistently on all tasks and also that the concept of conser-

vation of volume and of probability proved particularly difficult for the deaf to master. Although no comparison group of hearing subjects was used, it is important to note that Furth's group of subjects was generally older than the age at which hearing children would normally have acquired the concept of formal operation (Flavell, 1963; Bruner, 1964). Our interpretation of these findings is that the stage at which certain conceptual skills are evident is later in deaf than in normal hearing children. Furthermore, there is evidence that deafness does not equally affect all abstract reasoning processes. For instance, as Meadow (1975) has pointed out in her summary of some of Furth's earlier studies, deaf children show relatively little retardation in concepts of sameness and symmetry but have obvious difficulty in grasping the concept of opposition.

*Interim discussion*

In view of the various factors such as the problems of sample selectivity, age and the 'catching-up' phenomenon and test validity, caution must prevail when generalizing about the specific cognitive disabilities of the deaf and when attempting to explain and interpret them. Nevertheless, the weight of evidence supports the view that the deprivation of sound and its concomitant effect on language and other experiences tends to impose certain constraints on the deaf child's flexibility of thinking. The effect is that of comparative disability or impairment in certain areas of cognitive functioning, and in particular in those areas in which there is a greater demand for abstract thought.

This is not to say that the deaf are incapable of abstract thought, or alternatively that their thinking is of a 'concrete' nature. On the contrary, there is evidence that there is as reasonable potential for abstract thought among the deaf as there is among the hearing (Furth, 1966a; Lenneberg, 1967; Vernon and Miller, 1973). On the other hand, the evidence also suggests that higher levels of conceptualization, although not totally dependent on verbal functioning, appear to be facilitated by such functioning (Lewis, 1968; Chovan, 1972; Conrad, 1973; Meadow, 1975). In summary, while there is agreement that the deaf are capable of abstract thought and that they have relatively normal non-verbal intelligence there is disagreement as to how well the deaf cope in relation to certain abstract/symbolic tasks as compared with their hearing peers.

**Educational attainment**

Deaf children have also proved to be educationally retarded both in respect of reading ability, and in terms of progress with age, in reading

(Wrightstone *et al.*, 1962). The annual reading gain per year in terms of reading age is less than 12 months and therefore the absolute amount of educational retardation increases with age (Meyerson, 1963). Findings from the 1971 large-scale testing of academic achievement of the deaf under the auspices of the US Office of Demographic Studies (1973) have shown that deaf children show better achievement in reading in their first three years of schooling than in their later schooling, but after the early years tend to do better in spelling and in arithmetic than in reading. Nevertheless, it is evident that the academic achievements of these children are poorer than those of hearing children, and, furthermore, that the rate of improvement after the age of 12 years is particularly slow. There is the view, however, that these cognitive and educational handicaps are more often an indictment of the educational system than an inevitable consequence of deafness (Vernon, 1969, 1976). This suggests that greater effort is needed on the part of teachers of the deaf, and that more research into teaching techniques is necessary in order to find better ways of helping the deaf to realize their full academic potential at an earlier age than is apparently possible at present.

While in England concern has been expressed about the ability to teach deaf children to read (Watson, 1967), there has been little in the way of empirical studies of the relationship between extent of hearing loss and reading attainment. More recently Conrad (1977) has presented his findings on a study of the reading ability of deaf school leavers aged 15–16½ years. He reports that reading is significantly affected by degree of deafness and by level of non-verbal intelligence. He points out that if adequate reading is represented by a reading age of nine years only half of his deaf sample, regardless of their extent of their hearing loss, fall above this cut-off. Furth (1966b) adopts a more stringent criterion of a functionally useful ability to read which is achieved at about 11 years of age. Conrad points out that if this criterion is used then 75% of his sample would be considered as lacking adequate reading skills. He concludes that the reading performance in England and Wales is very similar to that of American children with both deaf populations reading very poorly.

### Factor analysis

Factor analysis can be undertaken on full (verbal and non-verbal) cognitive data of a partially deaf population but not on that of a profoundly deaf population because valid assessment of verbal abilities of the profoundly deaf is not possible. One of the few reported studies of factor analysis of a partially deaf population is that of Hine (1970). He administered a battery of tests, which included the WISC to a partially

deaf sample of 100 children age 8–16 years, and carried out a factor analyses on 24 variables. He found three important factors which he described as verbal ability, numerical ability and performance ability. A separate analysis on the WISC subtest data revealed the same three factors. This finding, as Hine claims, is in contrast to factor analysis of the WISC on normal populations in which only two main factors—verbal ability and performance ability—were found (Maxwell, 1959; Silverstein, 1969). Hine suggests, on the basis of his findings, that verbal, numerical and performance abilities tend to develop relatively more independently in partially deaf than in hearing children.

**Summary**

This briefly summarized review suggests that childhood deafness will constrain and hamper both language and cognitive development. In fact, there is ample evidence that the cognitive impairment is selectively concentrated on verbal abilities, as the deaf child population has much the same distribution of non-verbal intelligence as the general population (Murphy, 1957; Ives, 1967; Vernon, 1968; Myklebust, 1964; Wiley, 1971). Such selectivity is highlighted by the finding that deaf children's verbal IQs are affected more than their performance IQs with a mean discrepancy of 30 points in some studies (Lewis, 1968). However, even on certain non-verbal tasks, particularly those that require abstract skills, deaf children perform significantly less well than hearing children. It seems that the greater the level of abstraction needed for the task, the more likely it is that the deaf child will fare worse than the hearing child (Pettifor, 1968; McCarthy and Marshall, 1969), but this comparatively poorer performance on such tasks lessens with age.

Of crucial importance is the relationship between intelligence and language. Furth (1964, 1971) is of the view that thinking and cognitive processes can develop without the benefit of verbal language. However, the most common view is that if verbal language is impaired, cognitive development and learning will also be impaired (Oleron, 1953; Blank, 1965; Lewis, 1968; Myklebust, 1964). The situation is made even more complex by the fact that the deaf are not a homogeneous group. Not only are there different types and also different degrees of severity of deafness, but also differences in the age of onset. In most studies only a few of such factors have been considered. Without a detailed description of the sample it is difficult, therefore, to know how to interpret and assess findings.

Finally, it is necessary to comment on some of the other factors which are particularly likely to affect the cognitive functioning of the deaf. For instance, in certain cases the same brain pathology that caused the

deafness could also have caused the cognitive impairment. Other factors which have to be taken into account include the type and severity of deafness, the different modes of communication and language acquisition to which the deaf children have been exposed in their early years, hereditary factors and general quality of family life and social environment.

**Implications for our research**

With the above review in mind, the four main factors which could distort the picture obtained during our research are as follows:

(a) *Representativeness of the sample* As already stated, we believe our sample is as representative and typical of a total population of deaf children in a community as those used in any of the other major epidemiological studies.

(b) *Controlling for differences* between the groups of hearing-impaired and control children. Research workers have considered two main differences:

(i) *Social class factors.* In a previous chapter we point out that there is no significant excess of social and family pathology in our hearing-impaired sample as compared to the controls. Hence, any differences that emerge are unlikely to be determined by such factors.

(ii) *Intervening experiences.* The main intervening factors are whether the deaf child has a deaf parent and the type of communication used at home and at school. It is usually found that less than 10% of deaf children have deaf parents. This proved to be the case in our study where only one child (approximately 2%) had parents with a severe degree of deafness. As our sample tended to be small and as we wanted it to be representative, we did not exclude even that single case described above.

(c) *Measures used* While we agree that none of the measures used have been designed specifically to tap abilities of hearing and deaf children without being reliant on the hearing modality, we have confined our attention to those tests or subsections of the tests which we consider to be more appropriate for comparing deaf and hearing children. The problem with tests specifically designed for deaf children is that, with a few major exceptions (e.g. Drever and Collins), they are insufficiently standardized for age and/or have not been satisfactorily revised. In addition, insufficient experimental work has been carried out on these tests in relation to other types of handicap,

and also with normal hearing children of different ages. In these circumstances we decided to use well recognized standardized tests which have been widely used on deaf populations and, furthermore, to use only those subtests which we felt would be relevant for the deaf.