

3 A follow-up study: predictive importance—cognitive, language and educational development

Introduction*

The method employed in this follow-up study has been described in detail in Chapter 1. This is a study of children, with speech retardation at the age of three, who have been followed up at the age of about seven years. Material for the prospective study was gathered during a survey of the entire population of children born in 1962 in Newcastle upon Tyne (Neligan and Prudham, 1969). Speech retardation was defined as the failure to use 'three or more words strung together to make some sort of sense' (Neligan and Prudham, 1969).




This report concerns the 102 children whose parents were living in Newcastle when the children were aged three, and who were still available for study at the age of six years. As a result of the diagnostic assessment at the age of seven the study group was subdivided. One group comprised 18 children who were functionally extremely abnormal (these constituted the pathological deviant group). The remaining 84 children comprised the Residual Speech Retarded Group—the main subject of this chapter. This group of 84 children was operationally subclassified as follows (see Fig. 1):

- (a) Specific Speech Delay—a group of 25 children who had speech delay but started to walk early (complete data only available on 24 cases).
- (b) An intermediate group of 34 (complete data only available on 31 cases).

* A brief account of the method has been deliberately repeated in certain chapters in order to make them reasonably self-contained and thus simplify reading.

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WALKING MILESTONES OF RESIDUAL SPEECH RETARDED GROUP

Walking Age (months)			
Mean	S.D.		
11.21	1.41		Early walkers N=24
13.87	1.00		Intermediate N=31
19.04	3.94		Delayed walkers N=22

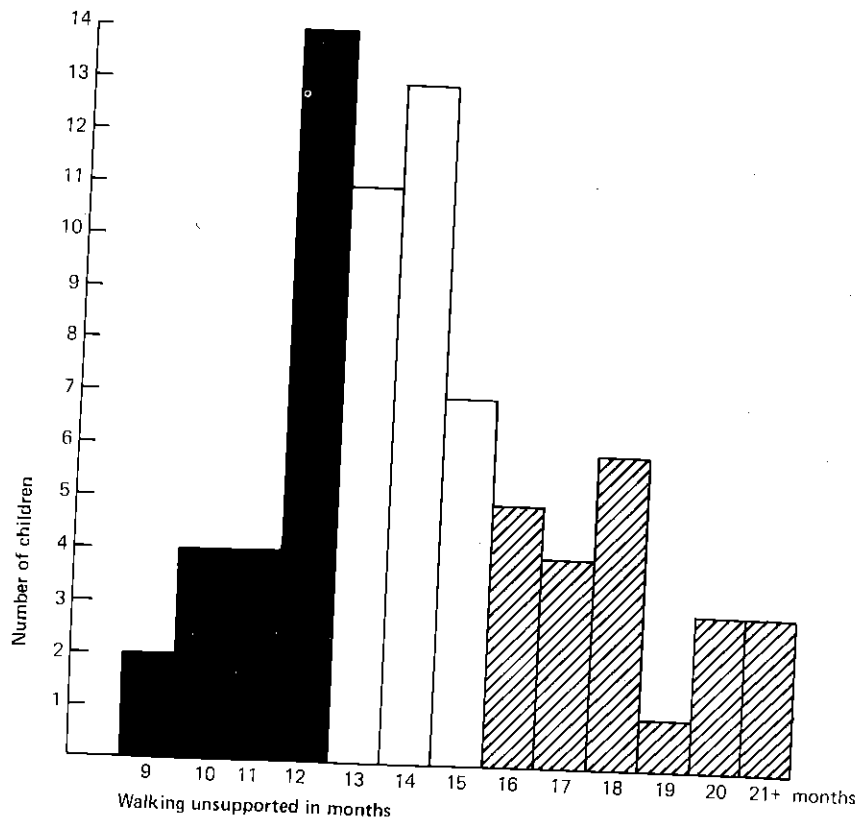


Fig. 1 Walking milestones of Residual Speech Retarded Group. In this histogram only the 77 cases with complete data were taken into account.

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- (c) General Milestone Delay—a group of 23 children who both walked and talked late (complete data only available on 22 cases).

As previously pointed out, the two deaf children were excluded from this classification.

The speech retarded group was matched with normal controls for age, sex and postal district.

Aim

This chapter is intended to be an account of the later development and functioning, in the three specified areas of cognition, language and education, of the 84 children who made up the Residual Speech Retarded Group. Although the main concerns of this chapter are between-group comparisons (between speech retarded and controls) some preliminary within-group comparisons are also undertaken.

It is of paramount importance to be aware of the long-term sequelae of speech retardation. There is evidence (Morley, 1965) that the use of incomplete sentences at the age of three years nine months rapidly improves, so that one year later very few children have this disability. Further, Butler *et al.* (1973) point out that by the age of seven years most developmental mispronunciations have disappeared spontaneously. Such apparent spontaneous improvements does not necessarily mean that henceforth all will be well, as there are reports of worrying long-term consequences. For example, the Edinburgh research group (Ingram, 1963; Mason, 1967) in their follow-up of speech retarded children in primary schools report that the majority have reading difficulties. In addition, Rutter (1972) points out that to read and 'to understand the meaning of what he reads . . . a child must have language skills'. He accordingly argues that speech delayed children are likely to have reading delays as well because both reflect language impairment. Long ago Sheridan (1948) pointed out that continuing mispronunciations betoken serious learning difficulties. Further retrospective studies of school age children with serious reading difficulties report that there is frequently a history of speech delay (Blank *et al.*, 1968; Rutter and Yule, 1970). Such studies deal in the main with educational problems. So far, no one has attempted to ascertain systematically and comprehensively, using a prospective research technique, what are the wider consequences of speech retardation.

Method

The method has been described in Chapter 1. We have made no attempt in this study to utilize the new linguistic concepts or explore the rules of

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grammar and language competence (Chomsky, 1957, 1965; Menyuk, 1964, 1969; Menyuk and Looney, 1972). These measures are still clinically in their infancy and need highly specialized skills for their application. Instead, we have used traditional clinical psychological measures such as the ITPA (Kirk *et al.*, 1968) together with a wide range of measures which include tests of language expression and syntactical development. For instance, Renfrew's test (1971) was modified and scored according to criteria adapted from the work of McCarthy (1930, 1954) and Templin (1957).

In certain analyses we have excluded the two profoundly deaf children as well as two children of uncooperative families.

A brief account of the tests used and what they measure is included in Appendix 2.

Findings

Walking milestones—observed and expected findings for Residual Speech Retarded Group

On the basis of Neligan and Prudham's population survey figures (1969), the expected numbers of children who are early, intermediate or late walkers have been calculated (Table I). Comparisons reveal that very many more children than would be expected from the general population walk late. Therefore, there is a clear association between retardation of speech and walking despite excluding the pathological deviant children. Nevertheless, there are a number of children who walk early thus indicating that speech retardation is not in every case necessarily associated with a delay in learning to walk. In short, the rate of walking development of the Residual Speech Retarded Group is not

Table I *Residual Speech Retarded Group divided according to whether the children are early, intermediate or late walkers, and analysed according to expected numbers based on the general population*

Subgroups	Observed <i>n</i>	Expected <i>n</i>	$\frac{(o - e)^2}{e}$
Early walkers	24	19.25	1.12
Intermediate walkers	31	50.05	7.25
Late walkers	22	7.70	26.56
Total	77	77.00	34.93

Chi-squared = 34.93, d.f. = 2, $p < 0.001$

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only significantly different from that of the general population but appears to be an important criterion for differentiating between subgroups of an apparently homogeneous population of speech retarded children. Furthermore, this method of subclassifying makes it possible to effectively study the sequelae of subgroups of speech retarded children separately.

Cognitive tests

On all the cognitive (intelligence, perceptual, conceptual, visual motor) tests the Residual Speech Retarded Group had significantly poorer results than the controls (see Table 2, Appendix 1). This applied equally to the global test scores and to the subtest scores (the latter are contained in the tables in Chapter 5). The obvious interpretation is that the poorer functioning of the Residual Speech Retarded Group reflects poorer intellectual potential. In other words, both their speech delay and their poorer cognitive functioning are simply indices of wider intellectual impairment. There is the possibility that too rigorous criteria have been used to define intellectual impairment (see Chapter 1) and that the above differences are just a reflection of this. One way of checking this is by comparing the distribution of IQ scores on the WISC and ascertaining how the picture would alter by using a higher cut-off point (see Table 3, Appendix 1). It is immediately evident that the verbal and full scale IQs of the Residual Speech Retarded Group show a marked shift to the left of the distribution curve with a less pronounced shift on the performance IQ.

We had also predicted that verbal skills would be closely tied to speech delay. There was therefore the possibility that if we had used verbal intelligence as our selection criterion we would have excluded children with a reasonable intellectual and educational prognosis. The findings in Table 3, Appendix 1, appear to justify our operational decision to use the performance IQ instead. For example, it is evident that, while in the Residual Speech Retarded Group 7½% of the children have verbal IQs below 70, none of the controls score as poorly as this: on the other hand, only 1% of the Residual Speech Retarded group (and none of the controls) have performance IQs below 70. Such discrepancies have great relevance in certain individual cases—for instance, one child had a verbal IQ of 69 and a performance IQ of 118 and would have been excluded from the study if the verbal IQ was the criterion. Even the use of the full scale IQ as an exclusion criterion would have been unjustified—although to a slightly lesser extent.

One explanation of the poorer functioning of the Residual Speech Retarded Group, as demonstrated in Table 3, Appendix 1, is that it is not really a homogeneous group, even though we have so far treated it as

Table II Cognitive functioning of Residual Speech Retarded Group subdivided according to whether they walked early or late

Measure	C = Controls (n = 100)		E = Early walkers 'specific speech' delay (n = 24)		I = Intermediate walkers (n = 31)		D = Late walkers 'general' delay (n = 22)		Significance (t test)			
	mean	s.d.	mean	s.d.	mean	s.d.	mean	s.d.	5%	1%	0.1%	
Full scale IQ (WISC)	96.26	9.92	91.21	10.10	88.52	11.23	83.27	10.26	C vs E	E vs D	C vs D	C vs I
Performance IQ	101.17	11.04	98.96	12.87	97.74	12.91	88.64	13.29	E vs D	I vs D	C vs D	C vs D
Verbal IQ	92.52	9.97	85.37	9.54	84.84	9.67	81.23	7.63		C vs E	C vs I	C vs D
Reading quotient (Schonell)	93.94	19.15	82.54	13.68	81.00	15.76	76.18	18.06		C vs E	C vs I	C vs D
Language quotient (ITPA)	91.31	10.09	84.12	8.91	82.19	10.94	76.20	9.88	E vs D	I vs D	C vs I	C vs D

such. Hence our analysis may have masked patterns specific to a subgroup. For this reason, in this chapter, we further analysed the data according to the subclassification outlined in the introduction, in terms of whether the child had a speech delay alone (specific speech delay) or a delay in both speech and walking (general delay). This constitutes a simple way of classifying the data and may not be sufficiently adequate or sensitive. Therefore in subsequent chapters we utilize other clinical and also statistical classifications.

An analysis of our findings (Table II) reveals that speech delay is a significant predictor of poor verbal and performance intelligence and of poor psycholinguistic ability and reading ability. However, this predictive power is considerably reduced for the group of children who have speech delay but walked early (their speech delay was specific). In fact, in this latter group speech delay is not predictive of performance IQ. As this group shows such a close fit on performance IQ with the controls, it can be argued that not all of the intellectual retardation which was found in the Residual Speech Retarded Group as a whole (Table 2, Appendix 1) can be explained away on the basis of a general intellectual impairment. The findings on the specific speech delayed group suggest the intellectual impairment of some children belonging to the Residual Speech Retarded Group may be specifically verbal and linguistic rather than general in nature.

For the Residual Speech Retarded Group as a whole, the WISC mean subtest profile (Fig. 2) was parallel to, but lower than, that of the controls. This appears to provide evidence of widespread impairment of abilities. Does this widespread impairment hold for the subgroups of the Residual Speech Retarded Groups—the early, intermediate and delayed walkers? It is clear that the profile of all three subgroups is, in general, depressed in relation to the controls. The profile of the early walkers is least depressed and that of the late walkers is most depressed, with that of the intermediate subgroup falling between the other two (Fig. 3).

Two main interim conclusions can be drawn: speech delay is a better predictor of impaired verbal intelligence than of performance intelligence; and combined delay in speech and walking is a good predictor of poor cognitive, language and educational development.

Later speech and language functioning

The Residual Speech Retarded Group proved to be significantly impaired on all tests of speech and language (Tables 4 and 5, Appendix 1). An analysis of these test results showed the following:

On the ITPA the Residual Speech Retarded Group showed a mean retardation of eight months compared with the controls. The profiles of both groups (Fig. 4) are roughly parallel and similar. The only points

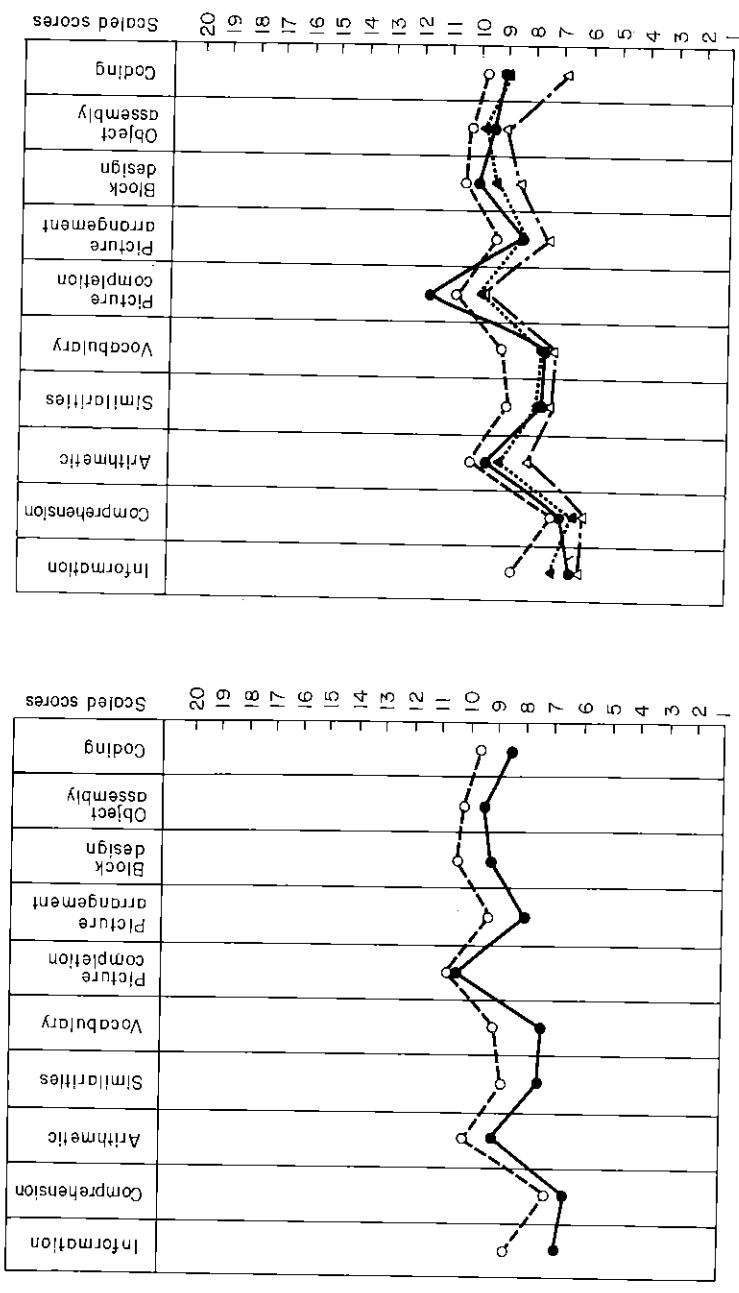


Fig. 2 (left) WISC profile of mean scaled scores for normal control and residual speech retarded groups
 Fig. 3 (right) WISC profile of mean scaled scores for normal control, 'specific' speech delayed, 'intermediate' and 'general' delayed groups

Subtest	Normal controls	'Specific' speech delayed	'Intermediate' group	'General' delayed
Information	10	7	7	7
Comprehension	10	7	7	7
Arithmetic	10	7	7	7
Similarities	10	7	7	7
Vocabulary	10	7	7	7
Picture completion	11	10	10	10
Picture arrangement	11	10	10	10
Block design	11	10	10	10
Object assembly	11	10	10	10
Coding	11	10	10	10

Fig. 2 (left) WISC profile of mean scaled scores for normal control and residual speech retarded groups
 Fig. 3 (right) WISC profile of mean scaled scores for normal control, 'specific' speech delayed, 'intermediate' and 'general' delayed groups

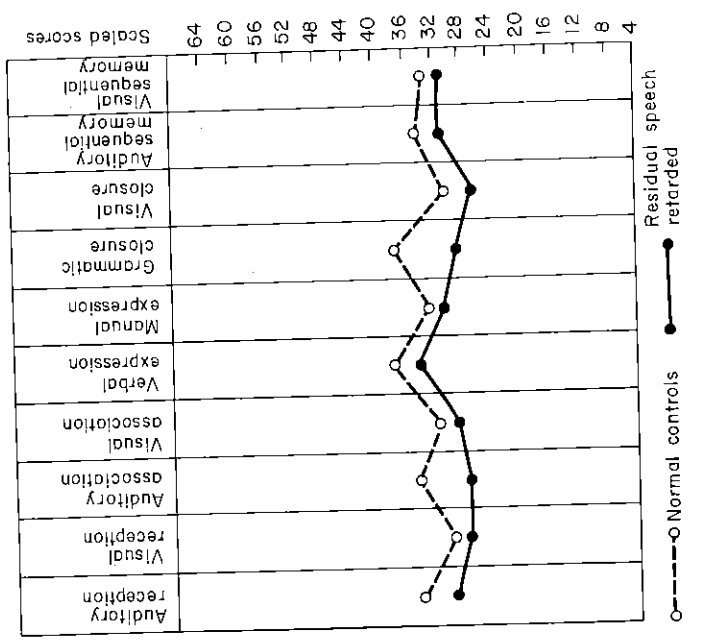
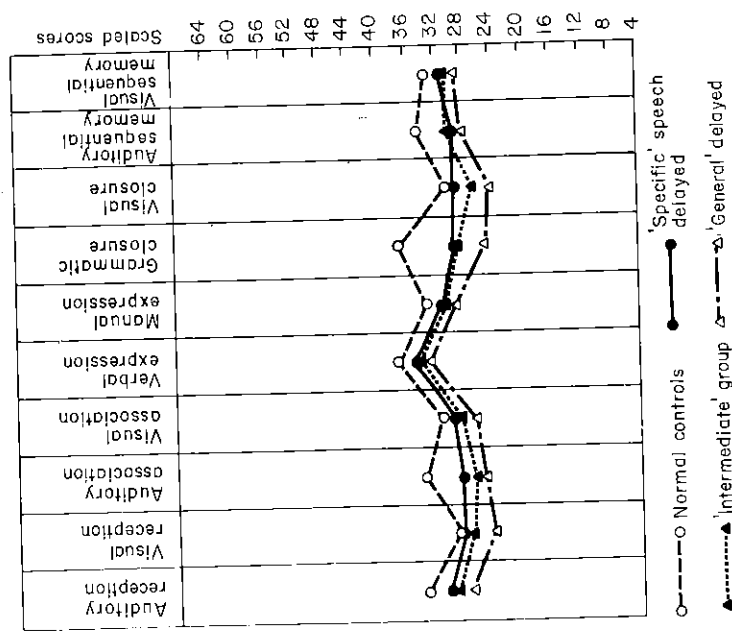


Fig. 4 (left) ITPA profile of mean scaled scores for normal control and residual speech retarded groups
 Fig. 5 (right) ITPA profile of mean scaled scores for normal control, 'specific' speech delayed, 'intermediate' and 'general' delayed groups

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where the profiles diverge is on Auditory Association and Grammatical Closure—where the children in the Residual Speech Retarded Group are particularly impaired. The simplest explanation of these findings is that the Speech Retarded Group show an overall immaturity of language development, but with some islands of deviant pattern of functioning as well.

Does the similarity of the ITPA profiles of the control and experimental groups also hold for the specific and general delay subgroups? Figure 5 shows that on nine of the ten subtests, each of the subgroups gave poorer results than the controls, with the general delayed (late walkers) having the worst results, the specific speech delayed (early walkers) having the best results and the intermediate group lying between these two. In addition, the greater impairment in Auditory Association and Grammatical Closure occurs consistently in all three subgroups.

On the articulation test the Residual Speech Retarded Group as a whole not only made a greater number of errors but also used more immature speech sounds (Table 5, Appendix 1). There is therefore evidence not only of a language delay, as demonstrated by the ITPA, but also of articulatory impairment.

The communication style of the Residual Speech Retarded Group also proved to be significantly poorer; in Bernstein's (1962) terms this can be described as veering towards the restricted pole of his elaborated-restricted continuum. The salient features of Bernstein's concept of the restricted code are: an inordinate use of simple as opposed to more complex grammatical construction; poor as compared with good syntax; simple and repetitive as compared with varied and logical use of conjunctions; limited and condensed use of words as compared with varied and flexible use of words; ideas used in a stereotyped manner instead of being expressed in a flexible, clearly organized manner, and so on. Furthermore, this is the style of communication that was thought to be a consequence of poor language stimulation and associated socio-economic disadvantage (Bernstein, 1962; Deutch, 1965; Hess and Shipman, 1965; Jones and Macmillan, 1973). In our study we have already demonstrated that the social class distribution (Registrar General's) of our Residual Speech Retarded Group does not differ significantly from the controls, and we have also found that the communication style of the mothers of the children of the two groups did not significantly differ. It is, therefore, not clear why our Residual Speech Retarded Group incline towards the use of a restricted code. A plausible explanation is that there may be a number of major determinants of the restricted style of communication described by Bernstein and that speech delay in early life may be one such determinant.

Another simpler way of looking at spoken language is to assess it in terms of sentence length, completeness and complexity (Templin, 1957;

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McCarthy, 1930, 1954). Here again the Residual Speech Retarded Group had poor results compared with the controls (Table 4, Appendix 1).

On the English Picture Vocabulary Test, which measures vocabulary and also provides information on the child's degree of verbal comprehension (Brimer and Dunn, 1962) the Residual Speech Retarded Group yet again had significantly poorer results than the controls.

Educational achievement

On both formal testing (Schonell Graded Word Test) and on teachers' assessments of the children's achievements at reading, writing and arithmetic, the Residual Speech Retarded Group proved to be significantly poorer than the controls (Table 2A Appendix 1). Similar findings have been reported by Ingram and Reid (1956), Ingram (1963) and Mason (1967) who followed up a group of Speech Retarded Children at school. In our study the designated subgroups again showed poorer educational achievement than the controls: results in the specific speech delayed group were better than in the intermediate group, which was again better than the general delayed group (Table II).

Imitation of gestures (Table 2, Appendix 1)

Sheridan (1969, 1972) has emphasized the importance of early imitation of activities and vocal utterances in the development of communication and the need for assessing imitative skills when assessing language functioning. Some consider (Rutter, 1972) that imitative play activities provide a 'useful guide to a child's "inner language" and basic language competence'. Such imitation and imitative play activities are usually assessed clinically only, for it requires clinical expertise to uncover such skills. The early imitation of gesture, word sounds and behaviour appears rather mechanical, but later there is a restructuring and re-ordering of material and increasing language comprehension. Rutter points out that, while the part played by imitation in the development of language is poorly understood and complex, serious impairment in imitation provides a warning of possible language difficulties.

There are few standardized tests with norms to assess such skills in older children (Sheridan, 1969). However, a test to measure the ability to imitate gestures of a non-symbolic nature has been devised by Berges and Lezine (1965), and a modified version of this test was used on our two groups. It was found that the Residual Speech Retarded Group was significantly poorer than the control at the imitation of gesture. This was to be expected as Rutter (1972) has pointed out that the use of gesture

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(imitation of gesture) is almost completely lacking in autism, only poorly present in mental retardation and moderately present in developmental language disorders. As we have already excluded children with autism and severe intellectual retardation, this finding is of considerable theoretical importance. Indeed, it is tempting to hypothesize that such poor ability to gesture may be an index of some type of receptive language disorder.

Principal component analysis of cognitive data—cognitive style (Fig. 6)

The patterns of cognitive functioning were explored further by a principal component technique. A principal component analysis was

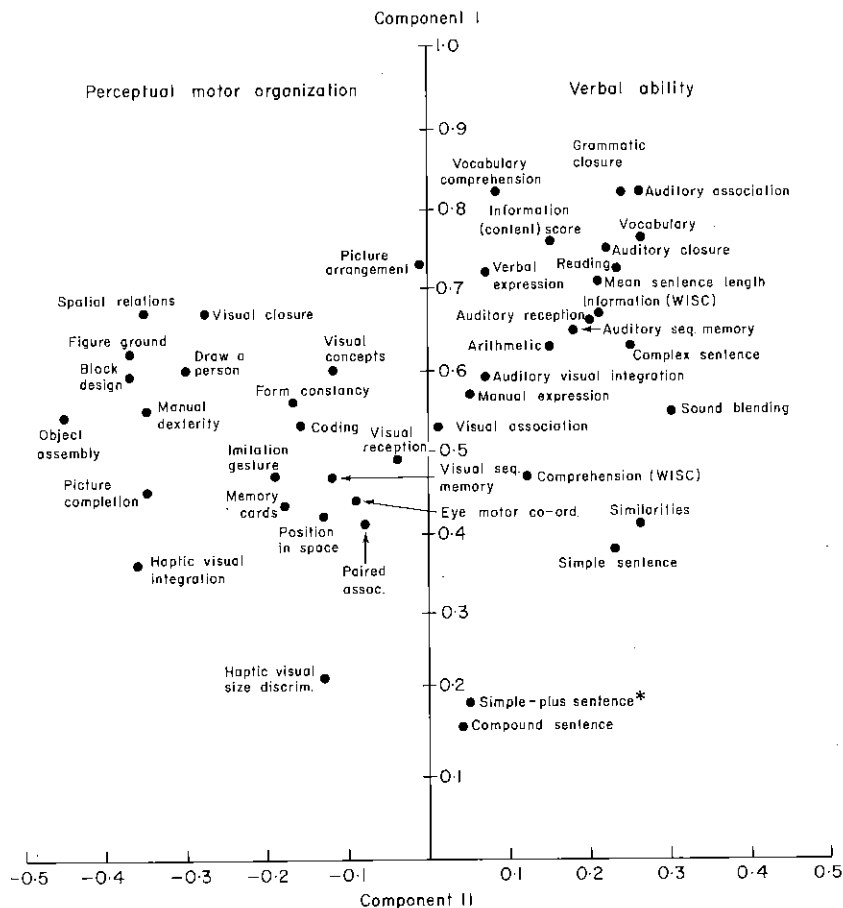


Fig. 6 Principal component analysis of cognitive data for control and residual speech retarded groups. * See p. 224 for definition.

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undertaken using 44 variables from the cognitive tests (Table 7, Appendix 1). From this analysis two clinically meaningful components were derived which together accounted for 39% of the variance.

The first component was a general one and accounted for 34% of the variance. This is reasonably consistent with Vernon's (1961) conclusion that the 'g' (General) variance comprises about 40% of the variance of human abilities. It was thus conveniently labelled 'general cognitive ability'. The second component, which was bipolar, accounted for only 5% of the variance. One pole was labelled 'perceptual motor organization' and the other 'verbal ability'.

On the first component, which represents general cognitive ability, the score of the Residual Speech Retarded Group proved to be significantly lower than that of the control group (Table 8, Appendix 1). Our findings are consistent with those in other studies (Eisenson, 1971; Sheridan, 1973) with all providing evidence that, as a group, speech retarded children are lower in general intelligence than the normal population.

As was to be expected, the scores of the Residual Speech Retarded Group on the second component incline towards 'perceptual motor organization' whereas those of the controls incline in the direction of 'verbal ability' (Table 8, Appendix 1). This clearly indicates that, at the age of seven to eight, the Residual Speech Retarded Group still shows a verbal/linguistic impairment. These findings are consistent with the ITPA and WISC profiles which demonstrate that the children in the Residual Speech Retarded Group carry out non-verbal tasks relatively better than they do verbal tasks.

Allowing for environmental influences

The contribution of social environment and other associated stimulating experiences merits examination. It will be remembered that by matching for postal districts we found we had only partly controlled for social class. In Chapter 1 we described a non-significant downward gradient of social class distribution of our study groups as compared with our control group. This downward gradient is reduced when we consider the Residual Speech Retarded Group alone (by excluding that group of children with serious pathology).

We, however, considered it necessary to check that the social environmental differences between the groups was not significant and for this purpose used the more sensitive measure (described in Chapter 2) namely, the social risk index. On this measure we found significant differences between the groups which we hypothesized were determined by a clustering of adverse social factors and child handicap even within

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the same neighbourhood. It was therefore necessary to determine whether such an environmental risk factor made an important independent contribution to the poor performance of the Residual Speech Retarded Group. For these purposes we decided to use a partialling out technique. In brief we allocated a score of 0 to the control group and 1 to the Residual Speech Retarded Group and produced a correlation of this variable with 13 separate measures of cognitive and behavioural functioning. Of the 13 resulting correlations 11 were significant. Thereafter social risk was partialled out and we found that the correlations usually only reduce slightly but on one occasion a previously significant correlation is no longer significant and further correlation which was significant at the 0.1% level is now only significant at the 5% level. We therefore concluded for practical purposes that the social environment differences between the groups were not sufficient to substantially affect outcome. We repeated the exercise in relation to the specific speech delayed subgroup and the controls and on this occasion only found six significant correlations, which were again only very slightly affected by the partialling out technique. We therefore conclude that the social environment had virtually no independent effect in the case of this subgroup.

Discussion

Some questions remain, not all of which can be answered by our data: is the widespread cognitive and educational impairment which we found in the Residual Speech Retarded Group wholly or partially determined by the earlier speech retardation, or has some of it, at least, its basis in the same factors as those which underline speech retardation itself? Is the major part of the variance of impairment determined by adverse environmental and psychosocial factors (various types of verbal and sensory impoverishment)? Have the assessment criteria used for designating our Residual Speech Retardation Group influenced our findings? Finally, is our Residual Speech Retarded Group heterogeneous, with the influential subgroups exerting an inordinate effect on the general findings so that the lack of classification is masking the emergence of other characteristic patterns?

We have already pointed out that the ITPA profile of our Residual Speech Retarded Group is parallel but lower than that of the controls, which suggests a general impairment of language. Similar findings with the WISC profile also suggest a general cognitive impairment rather than specific impairment for the Residual Speech Retarded Group as a whole. The masking effect of lack of classification is most evident in relation to the specific speech delayed group where there is found to be

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a specific impairment of verbal ability. This leads on to the crucial issue of the heterogeneity of the Residual Speech Group which is discussed in detail in Chapter 5 and in other chapters on correlational analyses and multivariate techniques in the classification of speech delay.

A related question is whether the Residual Speech Retarded Group contains a subgroup of previously dysphasic children. One way of answering this question would be to take a relatively unselected cohort of children who were previously speech retarded and see if the linguistic abilities of some of them resemble that of a clinical group of dysphasic children (Olson, 1961). Although the evidence of the ITPA does not support this hypothesis, it is possible that within this Residual Speech Retarded Group there exists a subgroup of children with a dysphasic type of disorder (see Chapter 5).

As described above, social environment only makes a small independent contribution to the poor functioning of the Residual Speech Retarded Group and virtually none in the case of the specific speech delayed subgroup. While the contribution of social and other stimulation is the subject of Chapter 2, social class factors can be examined immediately. In matching for postal district we only partly controlled for social class, and thus obtained a non-significant downward gradient of social class distribution of our study group compared with our control group. However, this downward gradient is reduced even further when the pathological deviant group is excluded. A more sensitive measure of social environment was developed which we describe as the social risk index. On this index there are significant differences between our control and speech groups. We therefore considered it necessary to partial out the influence of this factor (index) and found that it had little independent effect. It is unlikely, therefore, that social class factors play any major role in the differences we have uncovered in our speech retarded group.

There are some discrepancies between our findings and the important Edinburgh follow-up of speech retarded children (Ingram and Reid, 1956; Mason, 1967). In that study the mean verbal IQ of the group was 5 points higher than the performance IQ, possibly because this was a selected group with a disproportionate number of children in the upper social classes. This leads us to speculate whether the reverse verbal-performance IQ discrepancies of that study, as compared with the current study, are an artefact of selection.

It is to be expected that in a speech retarded group there will be a number of deaf children (Morley, 1965; Greene, 1967). In fact, there proved to be two profoundly deaf children. However, not even inclusion of these two children in the audiometric analysis gave rise to statistically significant differences between the controls and the Residual Speech Retarded Group (see Chapter 5 on Audiometric Examination).

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Their deafness precluded these two children from undertaking any psychological tests which included items with a verbal basis, and hence it is unlikely that hearing impairment determined any of the differences between the groups.

Conclusions

In Chapter 1 we demonstrated that one in five of a cohort of speech retarded children were seriously handicapped. If this extreme group (pathological group) is set aside, it is commonly assumed that the children in the Residual Group will soon overcome their speech disability and thereafter will function normally in most respects. However, some have shown (Ingram and Reid, 1956; Mason, 1967) that a high percentage of such children later develop educational disabilities. Our follow-up studies at the ages of seven and eight years reveal widespread cognitive, language and educational impairment including poorer intellectual ability, motor ability, imitative and intersensory skills; retarded language development; poorer articulatory ability and language skills, and a more restricted type of language expression. Principal component techniques showed that our Residual Speech Retarded Group not only had poorer 'general cognitive ability' but also inclined towards 'perceptual motor organization' whereas the controls inclined in the direction of 'verbal ability'. Such impaired functioning of children who were previously speech delayed is of major importance both diagnostically and therapeutically. It means that a child with speech delay in childhood merits careful assessment and appropriate help at school age or even earlier.

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